

JPRS-UST-86-028

10 DECEMBER 1986

546-0518-87

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USSR Report

SCIENCE AND TECHNOLOGY POLICY

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10 DECEMBER 1986

**USSR REPORT
SCIENCE AND TECHNOLOGY POLICY**

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ORGANIZATION, PLANNING AND COORDINATION

INTEGRATION OF SCIENCE INTO PRODUCTION DESCRIBED

Moscow EKONOMICHESKIYE NAUKI in Russian No 6, Jun 86 pp 44-49

[Article by Doctor of Economic Sciences G. Lakhtin under the rubric "Economic Laws and Socialist Management": "Scientific and Technical Progress and Expanded Reproduction"; passages within slantlines published in italics]

[Text] The transition of the economy to the track of intensive development as the basis for the accomplishment of the most important social and economic tasks, which were posed by the 27th CPSU Congress for the 12th Five-Year Plan and for the longer term, puts in the foreground the problem of the acceleration of scientific and technical progress. One of its main aspects is the mechanism of the management of scientific and technical progress and the necessity of improving it. The effectiveness of the practical measures being implemented in this direction depends to a considerable degree on how thoroughly economic science was able to reveal the nature of the processes relating to the accomplishment of scientific and technical progress.

In our view, the starting point in the analysis of the content of these processes is the thesis of K. Marx about the differentiation of two forms of the implementation of expanded reproduction--extensive and intensive. (Footnote 1) ("...Reproduction on an expanded scale: expanded extensively, if only the field of production is expanded; expanded intensively, if more efficient means of production are applied" (K. Marx and F. Engels, "Sochineniya" [Works], 2d edition, Vol 24, p 193)) Two "schemes" of expanded reproduction correspond to these forms: one presupposes the purely quantitative growth of production without any changes of a qualitative nature, which is expressed in the unchanged fundamental structure of capital; the other presupposes growth that is associated with changes of a qualitative nature and finds generalized expression in the growth in the fundamental structure of capital or, what is essentially the same thing, in the growth of labor productivity (the same quantity of living labor mobilizes a greater and greater quantity of embodied labor). The second form was examined in detail by V.I. Lenin in the work "Po povodu tak nazyvaemogo voprosa o rynkakh" [Concerning the So-Called Question of Markets]. (Footnote 2) (See: V.I. Lenin, "Polnoye sobraniye sochineniy" [Complete Collection of Works], Vol 1, pp 67-122)

A characteristic of the extensive type of reproduction is identity: each subsequent individual production process and each new produced unit of output are qualitatively identical with the preceding ones. The denial of identity is inherent in the intensive type of reproduction, updating, that is, the change of either the produced commodity itself (its use value) or of the process of its manufacture (the improvement of technology, which makes it possible to decrease the production costs), is characteristic of it.

Both types of reproduction are inseparably linked with each other and are realized in a contradictory unity: both the expansion of production and its development occur simultaneously. Their separation is necessary only for analytical purposes. At the same time the predominance of one or the other is evidence of the primarily intensive or primarily extensive development of production during one period or another.

Changes of the qualitative characteristics of a product and the production technology do not occur by themselves, but are the result of new technical solutions. Therefore, /the essence of intensive development is in the constant realization of the achievements of science and technology/. When the intensive type becomes dominant in the overall development of production, we speak of scientific and technical progress as the basis for this development.

Thus, two aspects are distinguished in the single reproduction process: the maintenance of the existing state and development, which included the negation of the given state. As applied to the production process this duality means that each such process combines the /manufacture/ of output and the /change/ of either output or the process of its manufacture. Accordingly, the created product also includes labor of a twofold nature: the labor of the aggregate worker in the production (manufacture) of the product as such and the labor of the aggregate researcher (Footnote 3) (By aggregate researcher there is meant here all "participants" in scientific and technical progress, beginning with the theoretical scientists and ending with those who directly introduce scientific and technical innovations in production), which is aimed at changing (developing) production. To understand the "duality" of labor in the above-named sense it is essential, in our view, to turn to the examination of the peculiarities of physical production under the conditions of the scientific and technical revolution. The duality in question can be shown most graphically on the basis of the example of new equipment. Since this is equipment, hence it represents an item that embodies the labor of producers; since it is new, (Footnote 4) (It is essential to consider that "new equipment" is not a description of some output, but a temporary designation. Every machine put into production was new during some period, but then ceased to be such. The transformation of a new machine into one that is "not new" takes place not as a result of changes in this machine itself, but because the economic conditions of the production and use of such machines change) consequently it embodies the labor of those who updated the design, improved its technical parameters in comparison with preceding models, or gave it new qualities, as well as the labor of those workers in physical production who participate directly in the introduction of innovations. The "duality" of modern production is a general law, and it consists in the fact that labor of two kinds: labor in manufacturing and labor in improvement, is incorporated in any product of production.

It is necessary, so it seems to us, to bear in mind the indicated theses when examining the question of the formation of the value of a commodity. As is known, K. Marx pointed out that "the value of every commodity is determined by the amount of labor materialized in the use value of the commodity, by the working time which is socially necessary for its production." (Footnote 5) (K. Marx and F. Engels, "Sochineniya," 2d edition, Vol 23, p 198) In this case the correspondence of the production conditions of a given commodity to social conditions is understood as the social necessity. In our view, this correspondence should be achieved not only in relation to the degree of economy of production, as is customary to believe, but also in relation to the perfection (quality) of the product, which reflects its technical level. Such an understanding is becoming more and more essential with the acceleration of scientific and technical progress and the increase of its influence on the development of production, which are expressed in the ceaseless process of updating and development. A product that does not correspond to the socially necessary level of perfection cannot become a commodity.

If at a given moment in time some part of a certain type of produced output possesses the best combination of consumer qualities (parameters) and amount of production costs, it can be called world-level output. Output of the same type, which is at the limit of public acceptability, on the verge of removal from production or the need for modernization, represents the opposite pole. Between these two poles lies an interval of qualitative states of the output, which represents during this period the socially necessary level of its qualitative perfection. It is fundamentally important that this level is continuously increasing, and, therefore, the relative share of the labor expenditures, which are socially necessary for the qualitative improvement of the output, in its total expenditures is increasing.

The question arises: How is one to determine the amount of socially necessary expenditures of labor of a researcher? Attempts to take the traditional path--to find some unit of scientific output and to derive the mean expenditures on it by analogy with the determination of the labor expenditures on the manufacture of a product--were not successful, although this approach makes some sense for the goals of standardizing labor. The individual nature and uniqueness of scientific and technical work have the result that the concept of /social/ necessity cannot be extended to the quantity of labor, which is expended on individual jobs (themes, developments, and so on). Each new grain of knowledge can be "produced" only once; then it becomes common property, while the labor connected with its production functions as universal labor. Thus, the qualitative boundary itself, which new knowledge crosses, is socially necessary, the transitions to it are individual.

In practice the indicator "science intensiveness," that is, the ratios between the amount of expenditures on research and development and the value of the produced output, is used to evaluate the expenditures, which ensure the achievement of the socially necessary level of perfection of the product. (Footnote 6) (See G. Lakhtin and Yu. Pavlenko, "The Indicator of the Sectorial Science Intensiveness," VOPROSY EKONOMIKI, No 2, 1984, pp 34-42). Processes of a dual nature determine the dynamics of the science intensiveness in each individual sector: its increase corresponds to the period of the

extensive development of the sectorial science; then comes a gradual slowing of growth, which concludes with the achievement of a certain maximum, which signifies that a sufficient scientific potential has been accumulated in the sector and the changeover to its intensive use is occurring. As the quantitative growth of the scientific potential diminishes, the volume of produced output continues to increase. As for the society as a whole, the appearance of new, more and more science intensive sectors is characteristic of it. Thus, according to estimates, such old, traditional sectors as the food, textile, and wood processing sectors have the least science intensiveness (on the order of tenths of a percent). Sectors that developed in the 19th or early 20th centuries (chemical and petrochemical, automotive and electrical equipment industries) belong to the medium science intensive sectors--for them this indicator amounts to several percent. The greatest science intensiveness is characteristic for the newest sectors--electronics (15 percent), the aviation industry (30 percent), and so forth. The indicator of science intensiveness serves as a characteristic of the technical complexity and perfection of production, as well as of the degree of its conversion into a "technological application of science."

Thus, a general law, which consists in the fact that the ratio between the labor of the aggregate worker and the aggregate researcher changes in favor of the latter, is characteristic of the development of production. Here the overall increase in the science intensiveness takes place through a transition to more and more science intensive sectors and types of production.

In our view, the allocation of labor for the qualitative improvement of output (production) and of workers involved in it, that is, labor and accordingly the workers who carry out scientific and technical progress, predetermines the distinction in the system for the management of social production of a subsystem which manages scientific and technical progress.

It is matter not only of the structure of management (the distinction of the organs which manage scientific and technical progress), but also of stimulation (separate payment of bonuses for the assimilation of new equipment, for example) and financing (the separation of the assets for the realization of scientific and technical progress in the form of unified funds for the development of science and technology). Inasmuch as scientific and technical progress encompasses all national economic units (not only production, but management as well), the need arises to establish a system of scientific institutions, /which corresponds to these units/: a network of sectorial scientific research institutes which correspond to the production structure of the national economy; scientific research organizations for the corresponding management units (the scientific research institutes of the State Planning Committee, the State Committee for Material and Technical Supply, the Central Statistical Administration, the USSR State Committee for Standards, and others). Thereby the convergence of the organizational structure of production and science is occurring and will occur further.

The integration of science and production does not exclude a certain setting apart of science as a separate sphere of activity. This isolation stems from such a factor as the differences in the nature of labor and its results in science and in physical production. The main thing consists in the difference

in the goal orientation of activity: the accomplishment of production (production of output), on the one hand, and the improvement of production, on the other. The dissimilarity of the mechanisms for ensuring the efficiency of these types of activity also stems from this. One should also keep in mind the time factor: first, the duration of the reproduction and science-production cycles is different; second, the advancing of assets for the development of production should lead the expenditures on carrying out current production, otherwise the development of production would come to a stop in expectation of new technical solutions. On the contrary, these solutions should lead the demand for them. The need to establish a system of the management of scientific and technical progress, which would make it possible to /foresee/ the needs for developments and ensure their timely implementation and introduction in production, follows from this.

At the same time the social need for a rapid and full realization of scientific and technical achievements dictates the necessity of the intensification of integration processes, which lead to the organizational and economic convergence of science and production and, subsequently, perhaps, also to their merging into an organic whole. This integration should be accomplished on a fundamentally new basis--/the priority of scientific and technical progress/, the leading role of science, and the transformation of production into its technological application.

The consideration of production (labor) as the dialectical unity of the processes of the manufacturing and the improvement of a product and the technology of its production presupposes the necessity of a more exact definition of the very concepts "science" and "production." In this context there is understood by science all activity, which yields new knowledge and leads to changes in physical production and other areas of social life, including the direct implementation of these changes, that is, the assimilation of the achievements of science by production. Such an approach to the definition of the concept "science" means, in turn, that production does not oppose science, because it /includes the realization of its results/. This is important to note, inasmuch as at times there is understood by production only reproductive activity, which actually does oppose scientific and technical development. The stated approach makes it possible to assume that the modern enterprise simultaneously performs as if two roles: it is both the manufacturer of output and a participant in scientific and technical progress, the final unit in the science-production cycle. And although these functions appear to be independent, inasmuch as each of them has its own final result, this independence is relative. At the same time their unity is also contradictory. In real life this contradiction is seen, in particular, in the fact that for the introduction of a new method and new technology it is necessary in one way or another to reorganize production, and this affects the fulfillment of the plan for the production of output. Stable output, just as the increase in the production of standard items, requires maximum stability of production (technology, equipment, organization, material flows, and so on). To remain up-to-date, however, production should be continuously improved by the updating of both the output and technology. But each introduction of something new is a radical change, a disruption of stability. In other words, the interests of extensive development (quantitative growth) are in constant conflict with the interests of the intensification of

production and its transition to a new qualitative state. The economic mechanism, which formed during the period of extensive development, gave priority to the quantitative aspect of production, which inevitably led to the relegation to the background everything that opposes /current/ production, its change and, consequently, improvement and progress.

But production cannot ensure the achievement of the ultimate goal--the meeting of the needs of the members of socialist society and the creation of the conditions for their all-round development--only on the basis of quantitative growth (which has definite limits), without qualitative improvement. A most important program principle of the CPSU is the provision of a qualitatively new level of the well-being of the people, for which the raising of the national economy to a fundamentally new scientific, technical, organizational, and economic level and its changeover to the means of intensive development are necessary. (Footnote 7) ("Programma Kommunisticheskoy partii Sovetskogo Soyuza. Novaya redaktsiya. Prinyata XXVII syezdom KPSS" [The Program of the Communist Party of the Soviet Union. New Version. Adopted by the 27th CPSU Congress], Moscow, 1986, p 25]) Therefore, one of the demands, which is being made on the economic mechanism under present conditions is the achievement of the unity of the planning of the production of output and the introduction of scientific and technical achievements, for which the changeover to /unified science-technology-production planning/ is necessary.

As is known, the management of current production is oriented toward the final, output indicators, of which the main one is the quantity of output in physical or value terms. Deviations of the actual value of some indicator from the desired (planned) value are a signal of feedback, which activates the management mechanism, which takes steps to eliminate the causes of the deviations.

In contrast to this, scientific and technical progress at present is not given by final, output characteristics; the plan specifies only its initial parameters: to introduce some technology, to assimilate some machine. Inasmuch as there is no controllable output parameter, the desired result cannot be compared with the actual result and, consequently, there is no feedback mechanism. In relation to the production process, each planned introduction of something new is a disturbance at input, which is not connected with the achievement of a specific indicator at output. The number of implemented measures on new equipment says nothing about how the state of production changed qualitatively. The plan assignment, which establishes the overall result of scientific and technical development, does not prevail over the enterprise, precisely for this reason it does not "pursue innovations."

Thus, the integration of the management of current production and scientific and technical development is being hindered by the fundamental difference between the mechanisms of management: current production is adjusted for deviation, on the basis of feedback; scientific and technical progress is adjusted for perturbation, without feedback. The former is significantly more effective, for precisely feedback makes it possible to keep track of results and react quickly to deviations from the assignment. On the other hand, the enterprises do not strive to introduce innovations, since the necessity of attaining the end result (indicator) does not force them to do this. From this

follows the urgent need to establish an indicator which is capable of servicing as a quantitative gauge of scientific and technical progress.

Inasmuch as all changes in the production process under the influence of scientific and technical progress reduce to the decrease of production costs and the achievement of the socially necessary level of efficiency, while all changes in output reduce to an increase in the level of its perfection, the changes of both the process and the product of production are subject to measurement (evaluation). Any improvement of the production process (technology, the equipment used, the organization of production and labor) is reflected in its costs. The improvement of output directly affects the change of its parameters (the appearance of new properties, the improvement of previous ones). /Their technical and economic level acts/ as an indicator, /which synthesizes the change of both the production process and the output/. In contrast to the economic impact, which characterizes the transition from the replaced equipment to new equipment (and not the new equipment itself), the technical and economic level is the direct resultant characteristic of the state which is achievement as a result of the introduction of innovations. Therefore, it can serve as the basis for the management of scientific and technical development on the basis of the principle of feedback. Being common to applied science, which produces technical innovations, and to production, which assimilates them, it makes it possible to combine the plans of science and production and thereby to implement unified science-technology-production planning.

The improvement of the planning of scientific and technical progress should be combined with the improvement of the system of material stimulation. And in this case one should take into account the difference of both aspects of modern production. For example, a brigade of steel workers might not be directly interested in the introduction of continuous steel pouring, whereas the interest of society as a whole in this is unquestionable. The material incentive for quantitative indicators, which are linked with the current production of output, opposes the payment of bonuses for the assimilation of new technology, moreover, the stimuli of the first kind are incomparably stronger (the payment of bonuses for new technology amounts to a very small share of the total amount of bonus payments). At the same time, to correct the situation and to ensure preference for the stimulation of scientific and technical progress, it is not enough, in our view, merely to strengthen the connection between material incentives and successes in scientific and technical development. Incentive measures, which are linked with the quantitative aspect of production, can also be stimulated by small qualitative changes in it: minor improvements, rationalization, and the "polishing" of existing technology contribute to the fulfillment of the plans of the current production of output and at the same time, as a rule, do not entail substantial progress of production. Scientific and technical development is really determined by major innovations of a revolutionary nature. They should be objects of centralized management and the unified scientific and technical policy. Enterprises should bear responsibility for them and economic stimulation will be an important supplementary factor.

In our view, the use of economic stimulation in the enterprises as a main lever of scientific and technical progress gives priority to evolutionary

development to the detriment of revolutionary development, which is aimed at the introduction of fundamentally new equipment and technology. It appears that it is impossible to achieve the decisive acceleration of scientific and technical progress merely through the increase of the economic interest of enterprises.

As for sectorial science, here, in improving economic stimulation, one should take into account the individual nature of creative activity and the necessity of its maximum activation. According to estimates found in the literature, the creative potentials of people in science differ by factors of 100 to 150. Such differences in scientific productivity cannot be reflected adequately in the remuneration of labor, inasmuch as this would lead to the excessive differentiation of wages. Accordingly, the effect of the law of remuneration according to labor in the sphere of science has substantial peculiarities.

One should also take into account the heterogeneity of science and the differentiation of the spheres of scientific activity on the basis of their connection with production. The greatest degree of separation from production is characteristic of basic science, which generates new knowledge and serves society as a whole. It is natural in this connection that it is envisaged by the Basic Directions for Economic and Social Development for the 12th Five-Year Plan and the Subsequent Period to give priority to the development of basic science, which predetermines the attainment by social production of a qualitatively higher level. Important organizational changes, which are linked with the inclusion of sectorial institutes in production and scientific production associations, which will serve its fundamental convergence with production, await applied science. (Footnote 8) (See: M.S. Gorbachev, "Politicheskiy otchet Tsentralnogo Komiteta KPSS XXVII syezdu Kommunisticheskoy partii Sovetskogo Soyuza, 25 fevralya 1986 g." [Policy Report of the CPSU Central Committee to the 27th CPSU Congress, 25 February 1986], Moscow, 1986, p 35) As to relatively minor innovations, which are called upon to improve the equipment and technology being used, the short time and cost of such work and its close connection with production presuppose the possibility of their direct inclusion in the reproductive cycle in the enterprises.

The more isolated a scientific sector is, the more grounds there are to evaluate its effectiveness according to its own achievements; the closer science is to production, the more grounds there are to evaluate its achievements in terms of the increase of the efficiency of production. Hence follows the expediency of differentiating the mechanisms of stimulation for academic and sectorial science.

Thus, a duality, which consists in the combination of quantitative growth (according to the classical scheme of expanded reproduction) and qualitative improvement (the updating of products and technology), is characteristic of modern production. These two aspects of development are not reducible to the same thing, therefore, the value is determined by the quantity of not only the socially necessary labor, which is expended on the production of a commodity, but also the labor which ensures the achievement by this commodity of the socially necessary level of perfection. Hence follows the legitimacy of distinguishing a subsystem of the management of scientific and technical

progress in the overall economic mechanism. Such a separation, however, serves as a prerequisite of the integration of science and production. In our opinion, integration should start with unified science-technology-production planning, for which it is necessary to introduce an indicator of the level type, which acts as a gauge of scientific and technical progress.

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FACILITIES AND MANPOWER

ROLE OF INTERBRANCH SCIENTIFIC TECHNICAL COMPLEXES DISCUSSED

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 17, 2-15 Sep 86 pp 4-5

[Interview with Academician Guriy Ivanovich Marchuk by A. Lepikhov: "Interbranch Interaction. Academician G. Marchuk Responds to the Questions of SOTSIALISTICHESKAYA INDUSTRIYA and NTR: PROBLEMY I RESHENIYA"; first paragraph is NTR: PROBLEMY I RESHENIYA introduction]

[Text] The strategy for managing scientific and technical progress that was developed at the 27th party congress requires available resources to be concentrated on key directions and free play to be given to the mass use of reliable technical innovations, which have been checked by practice, in order to obtain the maximal results from them and conduct quickly and purposefully scientific, planning, and design developments, which will ensure the development and assimilation of fundamentally new equipment and technologies, which increase labor productivity many times over. To obtain in the shortest time the leading levels in the world in priority directions of science and technology, to achieve a significant shortening of the cycle "from idea to machine," and to ensure the establishment of direct scientific, technical, and production relations with the corresponding organizations and enterprises of the CEMA member countries are the tasks that have been posed for the interbranch scientific technical complexes.

[Question] Guriy Ivanovich! Why have precisely interbranch scientific technical complexes been created for the attainment of the world level by our science and technology in the priority directions of research and development? Why have such great hopes been placed today in precisely this economic organizational form of the interaction of science and production?

[Answer] As you yourself understand, it is a matter not of the name. The main thing is the essence of the interbranch scientific technical complexes. They are a new economic organizational form of the interaction of science and production and the concentration of scientific forces and material, technical, and financial resources for the solution of major scientific and technical problems and the creation and assimilation of fundamentally new types of equipment and technology. In order to tell about the essence of interbranch scientific technical complexes, I will begin with the following. Without being afraid of erring, it is probably possible to say that our century is a century of increasingly narrow specialization. At least practically all that

has been created in the first half of the 20th century is the result of the labor of talented, educated, narrow specialists who know their business superbly. The figures of encyclopedists, who encompassed by their thinking if not all science contemporary to them, then vast spheres of knowledge, have become the property of history.

But nature is unique and complex. We know this truth well. In recent decades, the most significant breakthroughs in the sphere of new knowledge have been made, as a rule, at the junction of different areas of science. The birth of biochemistry and biophysics, chemical physics and molecular biology, physicochemical mechanics, and information science is a visible expression of the objective regularity of such a process. Research methods and equipment developed by physicists are used widely in modern chemistry, biologists are being provided with all the power of the body of modern mathematics and the unlimited capabilities of electronic computer technology, and specialists in information science are thinking about using biological media to store and process information.

It is perfectly natural that the practical application of the results of investigative research in such or similar areas of fundamental knowledge no longer fits into the framework of the traditional sectorial organization of industry and runs into specified organizational difficulties.

The first 18 interbranch scientific technical complexes (MNTK) have been created in the Soviet Union to overcome them and to open a wide road for the latest directions of engineering and the most advanced technologies, which are by their very nature interbranch and, to be completely precise, multibranch.

[Question] Is it possible to perceive their appearance as a kind of "legalization" of the already established practice of the work of our leading scientific and technical collectives?

[Answer] To a significant degree, of course. Take, for example, the world-renowned Institute of Electric Welding imeni Ye.O. Paton of the UkrSSR Academy of Sciences, which has now obtained the status of an interbranch scientific technical complex. The workers at the Institute imeni Ye.O. Paton were some of the pioneers of the interbranch approach to accomplishing the tasks that were posed for them. The developed technology and equipment for welding, spraying, soldering, and applying coatings, as well as the URI unit--a general-purpose hand tool for performing such operations in open space--are only a listing of several achievements of this collective. A strong experimental design and technological bureau, an experimental works, and a plant, where welding equipment has been developed, were already a part of it. Moreover, the workers of the Institute imeni Ye.O. Paton also specialized in operations in special electrical metallurgy and had the corresponding pilot plant at their disposal. They also had a specialized design and technological bureau for explosion metal working--again with their experimental works. All these subdivisions were united "under the roof" of the Institute of Electric Welding of the UkrSSR Academy of Sciences, where basic research was conducted and the theoretical bases of the latest newest technologies were developed.

Today, having become an interbranch complex, the Institute of Electric Welding imeni Ye.O. Paton has been strengthened by the enterprises of five all-Union ministries, which are taking part in its work.

Our work in powder metallurgy has begun to be developed in the framework of the interbranch complex. The Institute of Problems of Material Science of the USSR Academy of Sciences has become the main organization here. The revolutionary idea, which marked the beginning for a fundamentally new method of producing components, originated in the USSR in 1926. At that time well-known metallurgist P. Sobolevskiy proposed to abandon traditional metals and to use metal in the form of powders. Modern powder metallurgy, which is based on the latest achievements of physics, physical chemistry, and technology, makes the traditional processes of melting and pouring metals that were developed over centuries unnecessary.

[Question] Could you say what this is giving the national economy?

[Answer] I will cite only one example. Today machine builders are constantly dealing with expensive alloys. But when machining components, say made of nickel alloys, the metal consumption factor is very low, less than 0.7-0.8. In other words, 200 to 300 kilograms of components are obtained from each ton of rolled stock. All the rest--700-800 kilograms of alloy, which includes such expensive and scarce metals as cobalt, molybdenum, and niobium--is "unnecessary" chips. Powder metallurgy methods already make it possible to increase the coefficient of effective use of such materials by at least two- to threefold. It has been calculated that the transfer of every 1,000 tons of items for general machine building purposes designation to powder technology is a saving of 80 metal cutting machines, the labor of 190 workers, or within 1.3-1.8 million rubles.

Another very new direction of work is represented by the "Technological Lasers" Interbranch Scientific Technical Complex. In February of this year the scientific experimental and technical production base of its scientific research center was opened in the Moscow suburb of Shatura. Unlike the interbranch complexes, about which I spoke above, this one is not only academic. It has, if one may use the expression, two "masters"--the USSR Academy of Sciences and the USSR Ministry of the Electrical Equipment Industry. The staff members of the four scientific research institutes and the workers of the same number of plants, which belong to the interbranch scientific technical complex, have been presented with the task of creating high-performance equipment and technology for laser cutting and welding, heat treatment, tool hardening, as well as the organization of their industrial output. Yet another important task of the "Technological Lasers" Complex is to implement the large-scale introduction of laser equipment and the corresponding technology of working materials. This will make it possible to provide a significant saving of material resources and to increase the quality and durability of the most diverse machines and equipment. It is sufficient to say that just the laser thermal hardening of the head of a cylinder block, which has been assimilated at the AvtoZIL Production Association, made it possible to increase the life of motor vehicle engines significantly. A make-up of the first industrial technological laser in our country has already been prepared and is being experimentally developed in the laser center. In

essence, we are speaking about the birth of the future laser industry of our country.

Just as large-scale tasks of uniting the efforts of individual institutes and design bureaus have been posed for the "Personal Computer" Interbranch Scientific Technical Complex, of which the Institute of Informatics Problems of the USSR Academy of Sciences has become the main organization.

In the Basic Directions of the Economic and Social Development of our country for 1986-1990 and the Period to 2000 it is outlined to organize the mass output of personal computers, to increase the production volume of computer hardware by 2- to 2.3-fold, as well as to increase rapidly the scale of use of high-performance computers of all classes. The staff members of the "Personal Computer" Interbranch Scientific Technical Complex must not only develop, but also assimilate the output of systems of microcomputers that are unified not only with respect to architecture, but also the technological design and component bases, including personal computers. Of course, they must have appropriate software and peripherals for mass use in the national economy. In our current five-year plan it is proposed to manufacture approximately 1 million personal computers, which not only mathematicians, but also designers, production engineers, physicians, and economists, that is, people of the most diverse occupations, including the humanities, will use. But this, apart from everything else, means that the software for personal computers must, to use the language of specialists, be "friendly" and must not require special training to work with it.

[Question] The interbranch scientific technical complex is a new form of integration of science and production for our country. There is also probably much that is new in the purely organizational area.

[Answer] Absolutely. I will begin with the fact that the interaction of all the "links" of such complexes bears an obligatory, directive character. The list of the organizations of the different ministries and departments, which are part of the complexes, is confirmed directly by the USSR Council of Ministers. Furthermore, the main organization of the interbranch scientific technical complex--this is a strong scientific research institute--acts in relations to the organizations and institutions, which are a part of the complex, as a superior organ with all the rights and responsibilities which follow from such a status. The work of all the institutes, design bureaus, experimental works, and plants is carried out according to a unified plan.

There is another important feature of the interbranch scientific technical complexes. Their role is not limited only to the development of highly effective types of equipment, technology, and materials. An obligatory element of the activity of interbranch complexes is the promotion of the large-scale "duplication" of their achievements. For this purpose the interbranch scientific technical complexes submit to planning organs of the country proposals on the series assimilation of innovations, give the ministries and departments assistance in their highly effective use, and may create for this special engineering centers in their staff. Here once again the "relay race" of mass introduction, that is, the list of plants,

enterprises, and production associations, is confirmed by the USSR State Planning Committee.

[Question] What are the main tasks facing interbranch complexes?

[Answer] First of all, the interbranch scientific technical complexes are the main organizations in the country for accomplishing the scientific and technical tasks assigned them. This means that they conduct and coordinate both basic and applied research and experimental design and technical operations, manufacture test prototypes, and "bring" them to series production together with ministries and departments. Moreover, the formulation of proposals for drafts of the state five-year plans on the development in the country of corresponding directions in science and technology is another obligation of the interbranch scientific technical societies. In its own area, each complex determines the prospects for their development and the attainment in the shortest possible time of practical results which are not inferior to the world level. The preparation of drafts of scientific and technical programs on the most important national economy problems, as well as five-year and annual plans of the conducting of research, development, and pilot operations is another sphere of activity of the interbranch scientific technical complexes.

As you know, interbranch scientific technical complexes have been created for practical assimilation of the latest achievements of the bourgeois science. Therefore we still do not have enough specialists. Therefore, the interbranch scientific technical complexes, together with the corresponding ministries and departments, will also engage in increasing the skills of personnel. Moreover, they have been given the right to come forward with demands on the organization of the training of students in the new specialties that they need at higher and secondary education institutions.

I will add that the creation of information banks, automated ones, of course, which will reflect the latest achievements of domestic and foreign science and technology, as well as the organization of the information supply of all interested organizations and enterprises are also placed on the shoulders of the interbranch complexes.

And, of course, when speaking about interbranch scientific technical complexes, one must not forget that precisely they carry out and coordinate the research and development being conducted in the country in accordance with the corresponding assignments of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000.

Back in December of last year, 7 interbranch scientific technical complexes began performing the functions of the main organizations for 11 problems of 4 priority directions of this program. And quite recently, in June of this year, the USSR Council of Ministers made the decision also to extend to all remaining complexes the right granted to the main organizations to establish direct scientific, technical, and production relations with the corresponding organizations and enterprises of the CEMA member countries. Such a decision will undoubtedly make it possible to increase the effectiveness of the

scientific and technical cooperation of the countries of the socialist community.

[Question] Could you speak about the features of the management of the interbranch scientific technical complexes?

[Answer] Each of them is headed by a general director who is appointed by the USSR Council of Ministers. As a rule, the director of the main organization of this complex becomes the general director.

A council is created at each of them to solve the most important scientific, technical, and economic problems of the activity of the interbranch complexes. Its decisions are binding for all organizations and enterprises, which belong to the complex, as well as are participating in its work.

Now about the planning activity of the complex. The drafts of scientific and technical programs on the most important economic problems and of the unified five-year and annual plans of the conducting of research, development, and pilot production operations, and the distribution of resources and the amounts of capital investments among the performing organizations are the task of the main organization of each interbranch complex. These drafts, which have been submitted for approval to the corresponding ministries and departments, of which the interbranch scientific technical complexes are a part, are submitted to the USSR State Committee for Science and Technology.

A decree of the USSR Council of Ministers, which was adopted at the end of June of this year, provides that beginning in 1987 the assignments on the main indicators of the activity of the interbranch complexes and on the production of new types of equipment, technology, and materials, which have been developed at interbranch scientific technical complexes, will be included by the State Planning Committee of the country in the drafts of the state plans of USSR economic and social development.

[Question] Are there any peculiarities in the material and technical support of the activity of interbranch scientific technical complexes?

[Answer] Yes, there are. I will dwell only on the main ones. First of all, the orders of complexes for material and technical resources are filled in a priority order and in the full amount. Moreover, the directors of the scientific research institutes are well aware that no matter how hard you try, you will not provide for everything necessary in the draft of the plan--scientific research is not 100 percent amenable to regulation. And they can tell you with what difficulty it is necessary to strive for the allocation of an unplanned instrument or equipment. It is a matter here, as a rule, not of someone's bureaucracy--the available resources have already been distributed. Thus, with respect to the interbranch scientific technical complexes, the State Committee for Material and Technical Supply of the country, ministries, and departments are obliged to settle promptly the questions of the addition allocation to them of material and technical resources, the need for which arose already when fulfilling the established assignments. In the necessary cases the USSR State Committee for Science and Technology earmarks for the interbranch complexes additional financial and manpower resources from the reserve at its disposal.

There is another important situation. For a long time now we have been saying that many development for long years cannot get a start in life on account of the weakness of the experimental base. So that the capacity of the pilot production and experimental base, which is being created, once again in a priority manner, should ensure the checking the results of the research and development of the interbranch complexes within a period not exceeding 1 year.

I will add that there is an additional advantage for the organizations and enterprises, which are a part of interbranch scientific technical complexes: they are supported in a priority manner with the rental of devices, instruments, and equipment for scientific research.

[Question] How is the economic activity of the interbranch scientific technical complexes organized?

[Answer] I will dwell only on a few aspects of it. For example, a number of centralized funds have been created at the interbranch scientific technical complexes. One of them is the bonus fund. It is formed from two sources. The first is a part of the assets of interest ministries and departments, which are transferred by them from the corresponding centralized bonus funds. The second source is a part of the assets of the material incentive funds of the organizations and enterprises, which belong to the complex, as well as are participating in its work. Of course, such alienation of part of the material incentive funds can be carried out only with the consent of the corresponding labor collectives.

It is of considerable importance that the workers of the complexes receive bonuses not for completing some intermediate stages or others of the work, but only for developing, assimilating, and introducing new technology.

And since we are speaking of the development within interbranch scientific technical complexes of really new technology that is competitive on the world market, it is envisaged that a centralized fund of currency receipts is created here. It will be replenished by deduction from assets, which are received by the organizations and enterprises of the interbranch complexes and those taking part in its work, from the sale of their scientific and technical achievements--licenses and know-how, as well as the products being manufactured. Another source of the replenishment of this fund is part of the currency receipts obtained by outside organizations in case of the delivery for export of products manufactured on the basis of designs of the interbranch scientific technical complexes. In this way, incidentally, the problem discussed long ago of the material interest of the developers of products, which correspond to the world level or surpass it, is being solved. The unused balances of the centralized funds of the interbranch scientific technical complexes, both the bonus and currency funds, are carried over to the following year and are not liable to confiscation. Furthermore, the managers of the organizations and enterprises, which belong to the complexes, have been given the right to hire scientific, technical, and engineering personnel through the combining of jobs. The material interests of those workers of the interbranch scientific technical complexes, who are engaged

only in scientific organizational activity, are also not restricted. Their salaries are established in the same amounts as in the scientific research subdivisions. Moreover, the general director of the interbranch scientific technical complex has the right to increase the wages of the management personnel of the chief organization, who do not have an academic degree. This is done within the limits of the wage fund and only for the performance of functions on the support of the activity of the complex as a whole.

The remuneration of the labor of the staff members of the engineering centers, which are carried on an independent balance sheet, is also equated with that which is envisaged for corresponding categories of workers of the scientific research institutions, design and technological organizations, and pilot (experimental) enterprises.

[Question] Are there complications and difficulties in the way of organizing interbranch complexes?

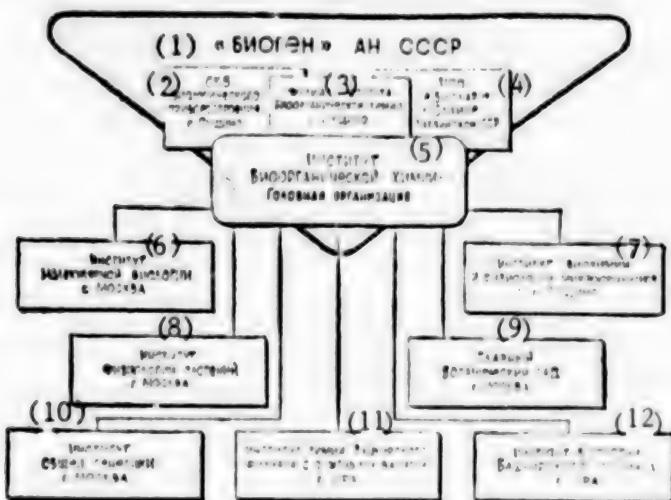
[Answer] Difficulties, of course, do exist. The decree on the establishment of interbranch scientific technical complexes was adopted in December of last year, when, as you understand, the majority of the items of the plan of the 12th Five-Year Plan had already been submitted for approval to tens of ministries and departments.

A large part of what I spoke to you about above when characterizing the life of the interbranch scientific technical complexes follows from the model statute on complexes, which was approved by the USSR Council of Ministers in June 1986. Of course, this model statute needs specific refinements for each of the complexes. There can be an average, standard approach here--the diversity of the problems being worked on within the interbranch scientific technical complexes is too great. Such work is now underway, but it has so far not been completed.

However, the main problems of organizing the life of the interbranch scientific technical complexes, of course, are already clear today. They can operate properly, if we can strictly observe the spirit and letter of the drafted Model Statute on the Interbranch Scientific Technical Complex. Namely, we actually provide the favorable economic climate that is necessary for their operation, organize the supply of all necessary material and technical resources, learn to respond to their needs expeditiously, form truly creative collectives of researchers, engineers, and workers, and form close contacts both with the collectives of academic institutions and with industry. Moreover, these must be contacts that are maintained not on the enthusiasm of individual personalities (although it is, of course, necessary), but on the basis of mutual economic interest. The interbranch complexes were established less than a year ago. We hope, by relying on the Interbranch Scientific Technical Complexes and adopting the achievements of academic science and the sectorial ministries, to use fully the advantages of the planned system of management for rapid movement along the path which was outlined by the decisions of the 27th CPSU Congress.

[Box, p 5]

Let us acquaint the readers with the standard structure of complexes, as well as with their main organizations and basic tasks on the basis of the example of the "Biogen" Interbranch Scientific Technical Complex.



Key:

1. "Biogen" of the USSR Academy of Sciences
2. Special Design Bureau of Biological Instrument Making Pushchino
3. Affiliate of the Institute of Bioorganic Chemistry, Pushchino
4. Bislar Scientific Production Association, Olayne, Latvian SSR
5. Institute of Bioorganic Chemistry, Main Organization
6. Institute of Molecular Biology, Moscow
7. Institute of Biochemistry and Physiology of Microorganisms, Pushchino
8. Institute of Plant Physiology, Moscow
9. Main Botanical Garden, Moscow
10. Institute of General Genetics, Moscow
11. Institute of Chemistry of Bashkir Affiliate With Experimental Bases, Ufa
12. Institute of Biology of Bashkir Affiliate, Ufa

Goals and Tasks:

The development on the basis of advanced technological methods, including genetic and cellular engineering, of new types of biologically active substances and compounds which make it possible to carry out the early diagnosis and combating of various diseases in medicine, horticulture, and veterinary medicine.

"Machine Reliability"

The main organization is the Institute of Machine Science imeni A.A. Blagonravov of the USSR Academy of Sciences, Moscow.

The development of diagnostics means (systems, test stands, equipment, sensors) that make it possible to ensure the increase of reliability and life of machines and components, as well as the substantial reduction of their metal content.

"Catalyst"

The main organization is the Institute of Catalysis of the Siberian Department of the USSR Academy of Sciences, Novosibirsk.

The development and introduction in industry of effective catalysts, the development of fundamentally new catalytic processes that make it possible to significantly increase the economy of energy resources and to reduce the production cost of basic types of chemical products.

"Anticorrosion"

The main organization is the All-Union Intersectorial Scientific Research Institute for the Protection of Metals Against Corrosion of the USSR State Committee for Science and Technology with a pilot experimental works, Moscow.

The development and introduction of fundamentally new types of equipment and technologies and means of corrosion protection that ensure the high corrosion resistance, wear resistance, and strength of materials and items, and an increase of the reliability and durability of machines and structures.

"Membranes"

The main organization is the All-Union Scientific Research Institute of Synthetic Resins with a pilot plant of the Ministry of the Chemical Industry, Vladimir.

The development and introduction of highly selective membranes for separating gaseous and liquid media, the development on this basis and the introduction of high-performance reverse osmotic, ultrafiltration, and electrodialysis automated separators for extensive use in the national economy.

"Petroleum"

The main organization is the All-Union Scientific Research Institute of Petroleum and Gas of the Ministry of the Petroleum Industry, Moscow.

The development of advanced systems for the working of petroleum deposits, effective technologies of the stimulation of productive beds, and hardware for their implementation, which promote the most complete recovery of oil and gas from the depths.

"Mechanical Processing"

The main organization is the Mekhanobr All-Union Scientific Research and Design Institute of the Mechanical Processing of Minerals of the USSR Ministry of Nonferrous Metallurgy, Leningrad.

The development and introduction of a new generation of crushing and pulverizing equipment, which ensures the more selective breaking of ores and materials, the significant reduction of the consumption of metal and electrical power, and the decrease of capital expenditures on ore preparation operations.

"Metallurgical Machines"

The main organization is the All-Union Scientific Research, Planning, and Design Institute of the Metallurgical Machines (VNIIMetmash) of the USSR Ministry of Heavy and Transport Machine Building, Moscow.

Combined solution of scientific and technical problems on the development, manufacture, and industrial introduction of new machines and units in steel making, pipe rolling, and stamping on the basis of new advance technological processes.

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USSR MEDICAL ACADEMY'S EVENTS CHRONICLED FOR 1983

Moscow VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR in Russian No 3, Mar 86
pp 89-94

[Article by Ye.K. Ponomar (Moscow): "In the Presidium of the USSR Academy of Medical Sciences"]

[Text] The Presidium of the USSR Academy of Medical Sciences heard the report of Vice President of the USSR Academy of Medical Sciences Academician of the USSR Academy of Medical Sciences S.S. Debov "On the Results of the International Scientific Ties of the USSR Academy of Medical Sciences in 1983."

The Presidium of the USSR Academy of Medical Sciences noted that international scientific cooperation of the USSR Academy of Medical Sciences in the period under review had developed in connection with the realization of tasks stemming from the decisions of the 26th CPSU Congress. It was directed toward the elaboration of effective methods and means of preventing, diagnosing, and treating the most common human diseases, toward promotion of the Leninist foreign and domestic policy of the USSR and the achievements of Soviet medical science.

Much attention was devoted to increasing the effectiveness of international scientific ties. Sittings of bureos of departments of the USSR Academy of Medical Sciences discussed questions pertaining to the effectiveness of international cooperation of a number of scientific research institutions.

The Soviet committee "Physicians for the Prevention of Nuclear War" attached to the Presidium of the USSR Academy of Medical Sciences actively participated in the work of the 3d International Congress of that authoritative movement (Netherlands, 1983). Owing to the initiative of Soviet scientists, the congress adopted important documents directed toward the further intensification of the efforts of physicians throughout the world against the nuclear menace.

In 1983, 403 themes were elaborated with socialist countries and 82 themes with capitalist countries (in 1982--364 and 92, respectively). There was bilateral cooperation with the German Democratic Republic, the Czechoslovak Socialist Republic, the Hungarian People's Republic, the People's Republic of

Bulgaria, the Polish People's Republic, the Socialist Federal Republic of Yugoslavia, the Mongolian People's Republic, and the Republic of Cuba. In all 28 institutions of the USSR Academy of Medical Sciences participated in joint CEMA research on 136 themes (in 1982--132). A total of 25 institutions of the USSR Academy of Medical Sciences participated in scientific cooperation with capitalist countries. The cooperation developed most successfully with Sweden, France, Finland, and the Federal German Republic. There was a noticeable trend toward the expansion of cooperation with Belgium and India. On the basis of 23 institutions of the USSR Academy of Medical Sciences 54 WHO cooperating centers and scientific projects are operating.

In 1983, 853 specialists went abroad for the purpose of taking part in joint scientific themes, studying foreign know-how, and participating in international measures (in 1982--894). In the period under review, institutions of the USSR Academy of Medical Sciences received 1,045 foreign specialists; the number of one-time visits was 1,040. On the basis of institutions of the USSR Academy of Medical Sciences 23 measures were implemented with the participation of 376 foreign specialists.

As a whole the international scientific relations of the USSR Academy of Medical Sciences in 1983 were carried out successfully. Cooperation with socialist countries, especially within the framework of CEMA, continued to expand; its forms were improved.

The publication of dozens of monographs, atlases, and textbooks, hundreds of articles in Soviet and foreign journals, and collections of works of symposiums, conferences, and so on was the result of joint research. Applications for invention and discovery applications were prepared. In the year under review, trips by Soviet specialists to foreign countries and by foreign specialists to the USSR resulted in 280 proposals on public health practice (the Clinical Medicine Department--88; the Medical and Biological Sciences Department--89; the Hygiene, Microbiology, and Epidemiology Department--108), of the 12 proposals were recommended for inclusion in the all-union plan of introduction of the USSR Ministry of Health.

At the same time in the conducting of international scientific cooperation there were difficulties in implementing the joint research themes, which are being jointly worked on with the Socialist Republic of Romania and the Polish People's Republic. Cooperation with Great Britain came to a virtual halt. Scientific cooperation with the United States in the year under review was at its lowest since the signing of the Agreement in 1972. Cooperation with Italy ceased.

The reduction of the length of time specialists spend on official trips and the failure to submit plans of report documentation on time should be classified among the shortcomings of international scientific cooperation. Great demands are not always made on candidates for foreign business trips. The documentation on international scientific cooperation, especially report documentation, remains extensive. The proposals on foreign business trips are being introduced slowly.

The more extensive enlistment of young specialists for the purpose of their study of foreign know-how and the increase of the length of assignment to 2-3 months with the performance of research within the framework of bilateral cooperation should help to make international scientific cooperation more effective. The extensive receiving of foreign specialists for purposes of familiarization is overburdening the leading institutions of the USSR Academy of Medical Sciences (the All-Union Cancer Research Center, the All-Union Cardiological Research Center, and others).

The Presidium of the USSR Academy of Medical Sciences endorsed the work on the fulfillment of the international relations plan of the USSR Academy of Medical Sciences for 1983 and approved proposals for inclusion in the "All-Union Long-Range Plan for the Introduction of the Most Important Advances of Medical Science in Health Care Practice With Respect to New Methods of Prevention, Diagnosis, and Treatment."

Departments and scientific institutions of the USSR Academy of Medical Sciences are ordered to exercise continuous oversight over the introduction of the proposals not included in the All-Union Plan of Introduction of the USSR Ministry of Health with respect to the results of international scientific cooperation in subordinate institutions.

The chief scientific secretary of the Presidium of the USSR Academy of Medical Sciences and academician secretaries of departments of the USSR Academy of Medical Sciences were charged to make provision for the analysis of the work on international scientific and technical relations and to include associates of the International Scientific Relations Department of the USSR Academy of Medical Sciences and the Foreign Relations Administration of the USSR Ministry of Health in the commissions when organizing and carrying out integrated checks on the activity of scientific institutions of the USSR Academy of Medical Sciences.

The Presidium of the USSR Academy of Medical Sciences heard a report of Corresponding Member of the USSR Academy of Medical Sciences B.F. Semenov on the state of the development effort in medical microanalysis. The Presidium of the USSR Academy of Medical Sciences noted that scientific research on the creation of immunoenzyme and radioimmune systems of diagnostic tests was being carried out in nine institutions of the USSR Academy of Medical Sciences: the Scientific Research Institute of Experimental Medicine imeni N.F. Gamaleya, the Virology Institute imeni D.I. Ivanovskiy, the Poliomyelitis and Viral Encephalitides Institute, the Experimental Pathology and Therapy Institute, the Medical Radiology Institute, the Experimental Cardiology Institute of the All-Union Cardiological Research Center, the All Union Cancer Research Center, the Therapy Institute of the Siberian Department of the USSR Academy of Medical Sciences, and the Uzbek Affiliate of the Virology Institute imeni D.I. Ivanovskiy. Parameters of immunoenzyme testing systems have been developed under laboratory conditions for the purpose of diagnosing influenza, hepatitis A and B, tick-borne encephalitis, tularemia, brucellosis, toxoplasmosis, and somatic diseases (indications of fibronectin, myoglobin, fibrin, and products of degradation of fibrin-fibrinogen). Authors' prototypes of kits for diagnosing hepatitis B, tularemia, brucellosis, and somatic diseases (the Scientific Research Institute of Experimental Medicine imeni N.F. Gamaleya,

Experimental Cardiology Institute, the All-Union Cardiological Research Center, Virology Institute imeni D.I. Ivanovskiy) have been tested. Radioimmunological kits have been developed for indicating viral antigens, hormones, and biologically active substances: hepatitis A and B, testosterone, estradiol, estriol, cancer-embryonic antigen, alpha fetoprotein, and myoglobin (the All-Union Cancer Research Center, the Experimental Pathology and Therapy Institute, the Medical Radiology Institute). Clinical and interdepartmental tests of developed radioimmunoassay kits have been conducted.

The pilot production of the immunoenzyme somatic systems, which was developed by the All-Union Cardiological Research Center, is being set up at the enterprise for the production of bacterial preparations of the All-Union Scientific Research Institute of Vaccines and Sera imeni I.I. Mechnikov of the USSR Ministry of Health. The Scientific Research Institute of Experimental Medicine imeni N.F. Gamaleya is prepared to produce antibody conjugates for the immunoglobulin of humans, as well as rabbits, and other animals. There is an industrial base for producing radioimmunological instruments.

At the same time there are shortcomings in work on medical microanalysis. A number of institutions still have not begun compiling standard technical production specifications for the immunoenzyme test system, the development of which has been completed.

The development of immunoenzyme test systems for diagnosing viral hepatitis A (the Virology Institute imeni D.I. Ivanovskiy and the Poliomyelitis and Viral Encephalitides Institute) is lagging behind the calendar schedule.

The preparation of systems envisaged for diagnosing infectious and somatic diseases is proceeding at a faster rate than the training of the personnel who will use these systems in their practical work.

The Presidium of USSR Academy of Medical Sciences, while noting the high scientific and technical level of scientific research work on immunoenzyme and radioimmune analysis, which is being performed at scientific research institutes of the USSR Academy of Medical Sciences, for the purpose of implementing the directives on medical microanalysis and the speeding up of its introduction into public health practice obliged the directors of the scientific research institutions of the USSR Academy of Medical Sciences:

--the Scientific Research Institute of Experimental Medicine imeni N.F. Gamaleya (director: Corresponding Member of the USSR Academy of Medical Sciences S.V. Prozorovskiy)--to prepare and submit according to the established procedure standard technical specifications for an immunoenzyme test system for diagnosing syphilis, to organize experimental production; to organize the industrial production of conjugates;

--the Experimental Cardiology Institute of the All-Union Cardiological Research Center of the USSR Academy of Medical Sciences (director: Academician of the USSR Academy of Medical Sciences V.N. Smirnov)--to submit for approval experimental production regulations and VFS [not further

identified] for immunoenzyme somatic test systems and to perform commission testing;

--the Virology Institute imeni D.I. Ivanovskiy (director: Academician of the USSR Academy of Medical Sciences V.M. Zhdanov) and the Poliomyelitis and Viral Encephalitides Institute (director: Academician of the USSR Academy of Medical Sciences S.G. Drozdov)--to submit for approval within the established time limits standard technical specifications for radioimmunoassay kits for diagnosing tick-borne encephalitis and hepatitis B;

--the Virology Institute imeni D.I. Ivanovskiy (director: Academician of the USSR Academy of Medical Sciences V.M. Zhdanov)--to conduct followup commission testing of the immunoenzyme test system for detecting Hb antigen;

--the Poliomyelitis and Viral Encephalitides Institute (director: Academician of the USSR Academy of Medical Sciences S.G. Drozdov)--to submit for approval instructions on preparing and monitoring immunoenzyme test systems for diagnosing tick-borne encephalitis and hepatitis A and to conduct author tests.

The Presidium of the USSR Academy of Medical Sciences appealed to the Main Administration of Educational Institutions of the USSR Ministry of Health to organize courses for practical public health workers on the application of radioimmunoassay-immunoenzyme assay methods of diagnosing infectious and somatic diseases on the basis of the Central Order of Lenin Institute for the Advanced Training of Physicians.

It was recommended to provide for the publication with "The Practical Physician's Library" of a series of manuals on diagnosing infectious and somatic diseases with the use of modern microanalysis methods. In this connection Corresponding Member of the USSR Academy of Medical Sciences B.F. Semenov, chairman of the All-Union Commission on Medical Microanalysis, was charged to prepare and submit a detailed report on this question to the USSR Ministry of Health.

In planning scientific research for 1985 and the 12th Five-Year Plan it was recommended to the All-Union Commission on Medical Microanalysis (chairman: Corresponding Member of the USSR Academy of Medical Sciences B.F. Semenov) to provide for the further expansion of both applied and basic research in the development of new, more sophisticated methods and systems of medical microanalysis.

The Presidium of the USSR Academy of Medical Sciences heard the report of Vice President of the USSR Academy of Medical Sciences Academician of the USSR Academy of Medical Sciences L.A. Ilin "On the Results of Scientific Research in 1983 on Problems of All-Union Significance."

The Presidium of the USSR Academy of Medical Sciences noted that the activity of all the scientific institutions participating in the fulfillment of planned research was carried out in accordance with the basic directions of scientific development work for the 11th Five-Year Plan.

In 1983 research of both a basic and an applied clinical and hygienic nature, which ensures the successful realization of tasks posed for medical science by directive organs, was conducted.

As a result of the research performed in the past year new data that are of substantial theoretical and practical significance for the further progress of medical science in the country were obtained. A considerable number of studies were devoted to the in-depth investigation of the mechanisms of biochemical, hygienic, immunological, and physiological processes of the vital activity of the body: new aspects of the pathogenesis and prophylaxis of diseases, which make it possible to substantiate the most effective ways of combating cardiovascular, oncological, viral, and occupational diseases, diseases of the nervous system, and endocrinial disturbances.

Scientific research pertaining to the protection of the health of mothers and children, surgery, gerontology, and therapy has developed intensively. The study of the questions of environmental hygiene and the rationalization of nutrition, the search for new medications, and the development and improvement of vaccine production underwent further development, the research of a biomedical and social hygiene nature on the problems of Siberia, the Far East, and the Far North, as well as in other areas of medical science, was continued.

As a result of the completion in 1983 of scientific research on 203 problems of all-union significance more than 4,800 themes were completed.

Most of the themes (over two-thirds of the scientific research) were completed on the order of the USSR Ministry of Health and the USSR Academy of Medical Sciences. In a number of scientific councils this indicator was higher: for antibiotics--100 percent; surgery--98.5 percent; immunology--94.7 percent.

The State Committee for Inventions and Discoveries registered four discoveries in the field of medicine. During the period under review more than 1,000 authors' certificates for inventions were received, which surpasses the number of them, which were received in previous years. Scientists in pharmacology and pharmacy, microbiology and neurology worked especially successfully in this direction. According to the data of the scientific councils, the largest number of inventions were registered in the field of forensic medicine, health resort science, physical therapy, and gerontology.

The analysis of the 1983 report cards, which was made in 40 scientific councils, showed that 9 percent of the completed scientific research work was evaluated as being of great urgency. The highest indicator of urgency is characteristic of biomedical problems--13 percent; clinical problems--9 percent; and hygienic problems--5 percent.

Evaluation of the perspectiveness of the results showed that 14 percent of the completed scientific research work can be grouped with themes that create the basis for searching for new ideas, approaches, theories, and conceptions. One-fifth of the scientific research work promotes the better understanding of already known phenomena, conditions, mechanisms, and regularities.

The results of one-third of the completed scientific research work in their nature correspond to their use in the sphere of medical science; two-thirds of the results--in the sphere of practical health care.

An important characteristic of scientific advances is their priority significance. According to the data of the reports of the scientific councils, out of 4,800 completed themes priority results are obtained when elaborating 618 themes, which is about 12 percent of the topics. This is twofold more than the analogous results in 1981.

In the area of biomedical problems priority results comprised 27 percent, clinical and hygienic problems--18 percent. On the average, there are 15 priorities for every scientific council.

The Presidium of the USSR Academy of Medical Sciences approved the report "On the Results of Scientific Research in 1983 on Problems of Union Significance."

The Presidium of the USSR Academy of Medical Sciences heard the report of Vice President of the USSR Academy of Medical Sciences Academician of the USSR Academy of Medical Sciences L.A. Ilin "On the Results of the Work of a Group of Hygiene Scientists of Familiarization With the State of Social Hygiene and Biomedical Problems in Krasnoyarsk Kray." The Presidium of the USSR Academy of Medical Sciences notes the following.

By virtue of its industrial potential, Krasnoyarsk Kray occupies a special place among Siberia's oblasts and krais. It is rich in fuel and energy resources and in large mineral deposits. Large industrial facilities have been put into operation there in recent years.

At the same time the kray's productive forces are being developed given a tight balance of labor resources. The existing shortage of manpower resources is the result of the noted adverse demographic indicators (migration of the population, morbidity, a low birth rate). As a result of the lag of nature conservation measures in a number of the kray's cities, adverse sanitary-hygienic living conditions of the population have developed.

Scientific research on environmental and labor hygiene and occupational pathology is for the most part performed by means of field trips of associates of the Scientific Research Institute of Hygiene imeni F.F. Erisman, the Novosibirsk Scientific Research Institute of Hygiene, the Sverdlovsk and Leningrad Scientific Research Institutes of Labor Hygiene and Occupational Diseases, and the Novokuznetsk Scientific Research Institute of Complex Problems of Hygiene and Occupational Diseases of the Siberian Department of the USSR Academy of Medical Sciences. Moreover, research on environmental monitoring is also conducted by laboratories and scientific research institutes of other ministries and departments (the Ministry of the Coal Industry, the Ministry of Nonferrous Metallurgy, USSR Academy of Medical Sciences).

Nevertheless, scientific research on environmental hygiene lags behind the kray's needs. There are no systematized materials on the sanitary-hygienic situation in industrial centers and in regions being newly developed. There

is no generalized information on actual pollution of the air, bodies of water, and the soil and on the impact of pollutants on sanitary-hygienic living conditions and on the health of the population.

The research on the study of natural-focus diseases needs intensification. Current sanitary-hygienic research disconnected and is not united by a common program. The "Integrated Hygienic Research in Siberia, the Far East, and the Far North" Problem Commission of the Scientific Council of the USSR Academy of Medical Sciences for Medical Problems of Siberia, the Far East, and the Far North is not performing intensively enough the work on the coordination of these operations in Krasnoyarsk Kray.

In accordance with the results of the work the group of hygienists drafted proposals on solving the urgent sanitation-hygiene problems, which were reported in the Krasnoyarsk Kray Committee of the CPSU and were discussed in the kray health department.

The results of the group's work were reported by Candidate of Medical Sciences L.G. Glebova in the bureau of the Hygiene, Microbiology, and Epidemiology Department of the USSR Academy of Medical Sciences.

The Presidium of the USSR Academy of Medical Sciences approved the report of Vice President of the USSR Academy of Medical Sciences Academician of the USSR Academy of Medical Sciences L.A. Ilin "On the Results of the Work of a Group of Hygiene Scientists on Familiarization With the State of Social Hygiene and Biomedical Problems in Krasnoyarsk Kray" and took cognizance of them.

The presidium considers it expedient to establish in Krasnoyarsk a laboratory of environmental and industrial hygiene as part of the Novokuznetsk Scientific Research Institute of Complex Problems of Hygiene and Occupational Diseases of the Siberian Department of the USSR Academy of Medical Sciences for the purpose of elaborating and coordinating sanitation and hygiene problems in Krasnoyarsk Kray on the condition that local soviet organs allocate the necessary production space.

Academician of the USSR Academy of Medical Sciences Yu.I. Borodin, chairman of the Presidium of the Siberian Department of the USSR Academy of Medical Sciences was charged in accordance with the established procedure to begin the organization in Krasnoyarsk in 1985 of a laboratory of environmental and industrial hygiene as part of the Novokuznetsk Scientific Research Institute of Complex Problems of Hygiene and Occupational Diseases of the Siberian Department of the USSR Academy of Medical Sciences.

The decision was made to send to Krasnoyarsk a group of scientists headed by S.G. Drozdov, director of the Poliomyelitis and Viral Encephalitides Institute, for the purpose of critiquing questions pertaining to the organization of an affiliate of the Poliomyelitis and Viral Encephalitides Institute of the USSR Academy of Medical Sciences.

The Presidium of the Siberian Department of the USSR Academy of Medical Sciences was charged to examine the following questions:

--the expansion of scientific research on urgent sanitation-hygiene and biomedical questions in accordance with the proposals of the working group of hygiene scientists for inclusion in the plan of scientific research of the Scientific Council for Medical Problems of Siberia, the Far East and, the Far North for the next few years;

--the strengthening of the coordination of scientific research on problems of labor and environmental hygiene in Krasnoyarsk Kray by the "Integrated Hygienic Research in Siberia, the Far East, and the Far North" Problem Commission.

The Presidium of the USSR Academy of Medical Sciences petitioned the RSFSR Ministry of Health on the necessity of reinforcing the kray's sanitary and epidemiological service with public health physicians and epidemiologists and to change the categories of kray and territorial sanitary and epidemiological stations.

The Presidium of the USSR Academy of Medical Sciences heard the report of Academician of the USSR Academy of Medical Sciences N.N. Trapeznikov, deputy chairman of the coordinating council, on the course of fulfillment of the program on solving scientific and technical problem 0.60.02 "To Develop Highly Effective Means and Methods of Diagnosing, Treating, and Preventing Malignant Tumors of Man" in 1981-1983, the Presidium of the USSR Academy of Medical Sciences noted that in 1981, 1982, and 1983 the research program had been carried out in accordance with the indicated plan. In all 107 scientific studies were completed and 1 of them was completed ahead of schedule.

In all 105 institutions of the country are taking part in the implementation of the program, of them 43 are of the nonmedical type.

As a result of the fulfillment of the work of the program new data on theoretical oncology were obtained, new methods for diagnosing and treating malignant tumors of certain localizations were developed, methods for detecting carcinogens in the environment, as well as means for reducing the level of their formation and contact with humans in the production process with the aim of preventing oncological diseases were developed. Ten antitumoral preparations were developed and submitted to the Pharmaceutical Committee of the USSR Ministry of Health for the purpose of obtaining permission for phase I or II of clinical testing, 13 procedural recommendations on the methods of determining carcinogenicity, on the treatment of certain nosological forms of tumors, on the prevention of the adverse effect of asbestos on the health of workers, and so on were prepared for publication or were published by the USSR Ministry of Health

The Presidium of the USSR Academy of Medical Sciences, in evaluating the positive work performed by the Coordinating Committee on the fulfillment of scientific research in accordance with the program, noted that the performance of research was negatively affected by difficulties in obtaining an adequate quantity of the necessary culture media and embryonal serums, by the limited number of large animals (dogs) and thymusless mice; the slow introduction of effective antitumoral preparations into practice; the insufficient or irregular supply of the oncological service of the country with existing

antitumoral preparations; difficulties with the industrial base for producing antitumoral preparations; the insufficiency of spare parts for costly imported equipment; the unavailability of proton beam equipment to conduct personnel in Dubna; the lack of a regular date for submitting reports and so on for instances, and so on.

The Presidium of the USSR Academy of Medical Sciences approved the fulfillment of the program for solving scientific and technical problem 0.69.02.

The All-Union Cancer Research Center of USSR Academy of Medical Sciences together with cooperating organizations was charged to take all necessary steps for the unconditional fulfillment of the assignment of the program on the use of proton therapy for cancer patients.

The Presidium requested the USSR State Committee for Science and Technology to examine together with the coordinating council of the program the course of fulfillment of the assignment on heavy particles with the aim of providing the conditions for its timely and high-quality fulfillment, as well as to expedite the settlement of the question of creating a tomography center at the All-Union Cancer Research Center of the USSR Academy of Medical Sciences, which is being organized in accordance with the decision of the Inter-ministerial Council of the USSR Academy of Sciences and the USSR Academy of Medical Sciences.

The Scientific Council for Nonionizing Methods of Intervention in Medicine by the Presidium of the USSR Academy of Medical Sciences was charged to draft a program of scientific research for the 12th Five-Year Plan on the development and clinical testing of domestic CAT scanners (X-ray, nuclear magnetic resonance; ultrasound, transmissive, and radioisotope scanning) and methods of laser methods of diagnosis and treatment.

Professor V.N. Gerasimenko, coordinator of assignment 05 of program 0.69.02, together with the working group of experts was charged to prepare a draft of procedural recommendations on the use of the oncological equipment intended for general prophylactic medical system of the population.

A.I. Shepelev, deputy president of the USSR Academy of Medical Sciences for administrative, economic, and financial affairs, Sciences, and Administration of the USSR Academy of Medical Sciences N.N. Trapoznikov, deputy director of the All-Union Cancer Research Center of the USSR Academy of Medical Sciences, were charged to pose to directive organs and construction ministries the question of the final completion of the construction of the All-Union Cancer Research Center of the USSR Academy of Medical Sciences (nukleotekhnicheskaya baza, isotope facility, radioactive waste treatment facility, and a number of other auxiliary services).

Based on the priority directions in the field of oncology (the study of the etiopathogenesis of tumors by molecular-biological and epidemiological methods, the development of methods for the early diagnosis and treatment of tumors, particularly drug therapy and primary prophylaxis), it was recommended to the coordinating council of program 0.69.02 to specify the specific program assignments for the 12th Five-Year Plan, as well as the scientific objectives

that will fulfill them, for the purpose of their priority manpower, financial, material, and technical supply.

The Presidium of the USSR Academy of Medical Sciences heard the report of Professor V.V. Liakhovich, head of the Cell Physiology and Pathology Department of the Clinical and Experimental Medicine Institute of the Siberian Department of the USSR Academy of Medical Sciences, "On the Status and Prospects of Research in Xenobiochemistry at the Siberian Department of the USSR Academy of Medical Sciences."

The Presidium of the USSR Academy of Medical Sciences notes the following.

In recent decades a new direction called xenobiochemistry emerged and has been developed in biological and medical science. The study of the metabolism of alien compounds (drugs, chemical carcinogens, toxins, pesticides, defoliants, food additives, chemical dyes, and others) in living organisms is its subject. Many laboratories and scientific centers, which are dealing with xenobiochemistry, have been opened and are in operation (the United States, the FRG, Japan, England, Belgium).

In the USSR the problems of xenobiochemistry are intensively studied at the 2d Moscow Medical Institute imeni N.I. Pirogov, the Bioorganic Chemistry Institute of the BSSR Academy of Sciences, the Clinical and Experimental Medicine Institute of the Siberian Department of the USSR Academy of Medical Sciences, the All-Union Cancer Research Institute of the USSR Academy of Medical Sciences, the Nutrition Institute of the USSR Academy of Medical Sciences, and the Chemical Physics Institute of the USSR Academy of Sciences.

Research in xenobiochemistry has been conducted since 1971 in the Cell Physiology and Pathology Department of the Clinical and Experimental Medicine Institute of the Siberian Department of the USSR Academy of Medical Sciences. At the present time the department consists of three laboratories.

Scientific research in the department is conducted in conjunction with institutes of the Siberian Department of the USSR Academy of Sciences (the Chemical Kinetics and Combustion Institute, the Organic Chemistry Institute, and the Catalysis Institute).

The Siberian Department of the USSR Academy of Medical Sciences has obtained the following results:

--spin-marked analogs of oxidation substrates that effectively inhibit the metabolism of xenobiotics were synthesized for the first time. Their testing under field conditions made it possible to ascertain the many-fold increase of the toxic effect of pesticides in case of their joint use;

--a method for determining the product of aminopyrine oxidation in the urine has been developed and is being introduced at a number of clinical institutions. This method is used for the diagnosis of the pathology of the liver, the monitoring of treatment, and in mass examinations of people at chemical enterprises;

--several molecular forms of cytochrome P-450, which catalyze the oxidation of drugs and chemical carcinogens were isolated in the form of individual proteins. Antibodies to these enzymes were obtained. This makes it possible to determine minimum amounts of individual forms of cytochrome P-450 in any medium, for example, in biopsy material;

--by means of inhibition analysis it was shown for the first time that a brief introduction of polycyclic carcinogenic hydrocarbons to various species of inbred mice is accompanied by an increase in the content of various forms of benzopyrenhydroxylase, which are distinguished by molecular activity;

--the bonding of a number of drugs--pyrazol derivatives--with iron ions in an active cytochrome P-450 center, which makes it possible to explain their inhibiting effect and to indicate avenues of the directed synthesis of substances that prevent the oxidation of xenobiotics, was shown for the first time by the nuclear magnetic resonance method.

The further development of research on problems of xenobiochemistry in the Cell Physiology and Pathology Department of the Clinical and Experimental Medicine Institute of the Siberian Department of the USSR Academy of Medical Sciences is checked by the slow development of material, technical, and manpower base and the insufficient cooperation of work in the eastern part of the country.

The Presidium of the USSR Academy of Medical Sciences approved of the research in the field of xenobiochemistry, which is being conducted at the Siberian Department of the USSR Academy of Medical Sciences, and recognized the represented direction to be urgent and promising for the solution of the complex problem of protection in the internal environment of man.

The Presidium deems advisable the development of the following directions in the field of xenobiochemistry at the Siberian Department of the USSR Academy of Medical Sciences:

--investigation of the structure and functions of enzyme systems which are responsible for detoxication and metabolic activation of xenobiotics, including chemical carcinogens;

--the elaboration of ways of regulating the activity of enzyme systems for the biotransformation of xenobiotics and the oxidation of endogenous compounds (steroid hormones, bile acids, and prostaglandins);

--the elaboration and introduction of new methods of preventing, diagnosing and pharmaceutically correcting man's pathological states, which are connected with disruptions of the structure and functions of the system for the biotransformation of xenobiotics.

The Scientific Council for the Planning and Coordination of Research on Molecular Biology and Molecular Genetics in the Field of Medicine of the USSR Academy of Medical Sciences together with interested institutions in order to concentrate efforts and coordinate research on the protection of man's internal environment has been charged:

--to draft a comprehensive program of research on the protection of man's internal environment;

--to hold regularly scientific symposiums on the key problems of protecting man's internal environment.

The presidium considers advisable the holding of a special session of the USSR Academy of Medical Sciences, which is devoted to complex problems of the protection of man's internal environment.

Scientific Council No 37 of the USSR Academy of Medical Sciences was charged to strengthen the coordination of research in xenobiochemistry in the eastern part of the country.

It was recommended to the Presidium of the Siberian Department of the USSR Academy of Medical Sciences to examine the question of the possibility of strengthening the material, technical, and manpower base of research in xenobiochemistry.

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AUTOMATION AND INFORMATION POLICY

PRODUCTIVE ROLE OF SCIENTIFIC INFORMATION CENTERS STRESSED

Moscow PRAVDA in Russian 10 Sep 86 p 3

[Article by O. Kedrovskiy, chief of the Association for the Management of Scientific and Technical Information and Propaganda in the RSFSR attached the State Committee for Science and Technology: "Lessons of Information. Accelerate Scientific and Technical Progress"]

[Text] Our country has a highly developed network of scientific and technical information institutes and centers. The All-Union Institute of Scientific and Technical Information, the All-Union Scientific and Technical Information Center, the Poisk Scientific Production Association, USSR State Public Scientific and Technical Library, and other all-union information organs have vast collections of scientific and technical literature and documentation. The most abundant materials on the latest achievements in our country and abroad have been collected at sectorial institutes and territorial centers. Many of the specialized information institutions have been furnished with advanced equipment, powerful technical complexes for processing, retrieving, and transmitting information have been established there.

And all the same thousands of specialists still continue to exist on an information starvation "diet," often without even suspecting this. The results of the state examination of inventions attest that more than half of the applications are rejected annually due to the absence in them of elements of novelty. Millions of rubles are spent in vain on their formulation. However, this is a small part of the harm that the reproduction of backward solutions is doing to the national economy.

Between the information centers and those who require their products lie unfinished sections of the information road, frequently at the closest approaches--the specialist's workplace. At enterprises and organizations in many instances conditions have not been created for the unhindered acceptance and effective utilization of scientific and technical data....

Such is the consequence of the erroneous ideas, which have become ingrained among many economic managers, about the weak influence of information services on the end results of production and scientific and technical activity. Ideas, which are influenced, on the one hand, by the traditions of the time when the quality of developments or the technical level of production was not

considered the main gauge of success in work and, on the other, by personal impressions from the unqualified organization of information work.

This situation can be altered by relying on the experience of leading enterprises and organizations, having reflected their practice of utilizing information resources in standard documents. The state standard for the information support of research, development, and work on improving production could become a most important lever here. The basic possibility of its creation is confirmed by the experience of the development and application of the all-union state standard for patent research.

However, it is a question not only of the poor organization of the "information approach lines." The effective transportation of information products is hindered by the lack of coordination in the actions of information institutes and centers that are subordinate to different departments. The difficulties here are numerous. The 228 central information organs belong to 108 ministries and departments.

The need for precise concerted actions of partners became obvious with the organization of technological ties between automated scientific and technical information systems. The transition to the regular dissemination of magnetic tapes and the transmission of information over communications channels graphically demonstrated that the network of specialized information organizations should be regarded as a single technological complex. Not without reason do the specialists working in different economic regions of the country receive a considerable portion of the information of all-union and sectorial centers through regional centers.

Under these conditions, all the advantages of automation and accordingly the quality of the information supplied (especially its timeliness and completeness) are preserved only if all the links in the "technological chains," which connect all-union, sectorial, and territorial centers with the customer, work efficiently.

Unfortunately, the violations of the completeness and deadlines of the delivery of information frequently has the result that the information reaching specialists on magnetic tapes has long been known to them from other sources.

The nonproductive duplication of information is increasing. Thus, a considerable portion of the data received by territorial centers from all-union organs is subsequently repeated in reports received from sectorial information centers.

The deadline for performing reciprocal obligations in the network, the promptness and completeness of deliveries of information, the activation of search files and the corresponding remote access points for transmitting requests and receiving messages--all this requires centralized monitoring and regulation.

The exercise to the full extent of the rights of the State Committee for Science and Technology in the management of the system of scientific and

technical information in the country in close cooperation with the newly created USSR State Committee for Computer Technology and Information Science seems especially important precisely in this direction.

Many difficult, rather costly problems have been solved in order to accelerate the processing and transmission of data over thousands of kilometers. Powerful computer technology and sophisticated devices for receiving and transmitting over communications channels have been put into operation. And of all this is frequently depreciated owing to the lack of simple, inexpensive fast copiers. Territorial centers, which are responsible for mass information support of enterprises and organizations, suffer particularly from the lack of such devices. The materials needed by specialists, the brief content and address of which has been found in a split-second by computer, often wait in line there for weeks to be copied....

This is not only an impediment to the transmission of information, but also a serious obstacle to its effective utilization.

The steps outlined by the 27th CPSU Congress on increasing the scientific and technical level of research and development, operating machinery and technology require that the collections of the most significant literature and documentation be brought closer to enterprises and organizations. There, it is necessary to them only with patent documentation and standard technical specifications, but also with information on industrial equipment, specialized scientific and technical journals, and copies of translations of important sources of foreign information. The centers operating in Siberia and the Far East have particular need for all-round improvement of the territorial collections.

Finally, one of the main reasons behind the shortcomings in our information work is that its economics and organization are largely based on traditional concepts. It may still seem to some people that scientific and technical information institutes and centers belong to the nonproduction sphere and that they are not engaged in producing a product that is important to the national economy. At the same time from a technical and technological point of view these organizations differ little from industrial enterprises. The technical complexes operating there, which combine computers, automatic photo typesetters, microfilming and printing equipment, are essentially one of the types of semiautomatic production lines with which the leading enterprises are equipped.

The value of the fixed capital of leading information institutes and centers presently runs into the tens of millions of rubles. The production of the "information product" is thus becoming a more and more costly business.

On the other hand, practice convincingly shows that the production of scientific and technical information is one of the most effective types of national economic expenditures. The use of innovations taken from information materials is an important source of the economic effect from the introduction of scientific and technical achievements. The effect of the repeated use of inventions in the national economy greatly exceeds the expenditures on maintaining the given information institutions.

Thus, the cost of preparing the information resource is increasing, while its successful use is yielding an ever larger return. But, unfortunately, this return is as yet far from the maximum. Much important information never finds its users. At information institutes and centers there are practically no economic levers and stimuli that orient the personnel toward the improvement of the basic quality indicators--the timeliness, completeness, purposefulness, and substantive significance of the materials delivered. The information "gross" acts as the main indicator of the activity of the centers.

How can it be overcome, how can things be brought in line with the new conditions of management? An entire set of long-term measures, which ensure the stage-by-stage solution of problems, is knocking at the door. It is necessary to begin with the principles of the economics of information activity, with the formulation of a clear view of the very concept "information product." How does it differ from the knowledge and experience, which have been gained in the process of scientific and technical development? What is the "standard net output" of information centers and services in this regard? What are its quantitative and qualitative characteristics, what is the impact of use for the consumer?

In answering these difficult questions, it is necessary to take immediately practical steps to convert information institutes and centers to cost accounting. It would be possible to begin with intersectorial territorial centers.

Here only those questions, whose solution will not require large additional expenditures, but will yield an appreciable return in the quality indicators of the information system, have been touched upon. But without the acceleration and qualitative improvement of information, it is difficult to speak about acceleration in general.

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CSO: 1814/23

SOCIO-POLITICAL FACTORS

SYSTEMS NATURE OF GLOBAL MODELING

Moscow OБЩЕСТВЕННЫЕ НАУКИ in Russian No 3, 1986 pp 103-117

[Article by Academician Dzhermen M. Gvishiani,* deputy chairman of the USSR State Planning Committee, director of the All-Union Scientific Research Institute of Systems Research of the USSR State Planning Committee and the USSR Academy of Sciences, chairman of the Council of the International Institute of Applied Systems Analysis; capitalized passages published in boldface]

[Text] The study of global problems of the present is becoming an important and vital task of Soviet scholars today. Global problems, it is stated in the new version of the Program of the CPSU, "have especially intensified in the second half of the 20th century and have become vitally important to all mankind: environmental protection; energy, raw material, food, and demographic problems; the peaceful development of space and the resources of the world ocean; the elimination of the economic lag of many liberated countries; the eradication of dangerous diseases, and others. Their solution requires the concerted efforts of all states."¹ The study of global processes is not limited today to purely scientific, cognitive goals, we need not only to study them, but also to learn how to control them, that is, we need to solve an important practical problem that will determine the future direction of scientific, technical, and socioeconomic development.

The successful solution of this problem requires the enlistment of knowledge and methods from various disciplines and the unification of the efforts of scientists who are specialists in the natural sciences and the humanities. Global modeling, which uses formal mathematical and substantive research methods, is one of the modern methods used in the integrated, interdisciplinary study of global problems, which is based on the principles of the systems approach. These methods ensure the necessary synthesis of knowledge about individual aspects and elements of the global system.

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In the present article, we shall examine the basic questions relating to the modeling of global structures and processes, its systems characteristics, specific features, and the methodological structurization of the object of study and the social nature of systems modeling.

SYSTEMS NATURE OF THE MODELING OF GLOBAL STRUCTURES AND PROCESSES. Systems analysis, which uses the data of social, natural, and technical sciences and integrally combines the coordination and integration of various types of activity, has become the most important methodological tool for understanding various aspects and processes of the global system and their management. Systems analysis, by relying on philosophical and methodological methods of the management of complex systems, not only makes it possible to form an integral picture of the interrelations between scientific and technical progress and the development of society, but is also serves as a practical tool for optimizing the management of complex world processes. One of the effective directions of systems analysis is global modeling.

The principles of materialist dialectics constitute the theoretical basis of the computerized systems modeling method--the best suited one at the present stage of the study of global processes.² This new method of socioeconomic knowledge and management, which is a special, technical tool, is subordinate to the general Marxist-Leninist theory of development of nature, society, and human thought.

Global modeling is closely associated with the basic principles of the systems approach. It is the conception of the interdisciplinary integrity of the process of studying a global object and the principle of the systems integration of knowledge (data of practically all modern scientific disciplines are synthesized in global models). The philosophical idea of the unity of nature substantiates the possibility of fruitful scientific synthesis. The systems approach and systems modeling view man as the goal of the historical process, all criteria and principles of these scientific methods are oriented toward the needs and interests of man as the highest asset (it can therefore be said that narrow economic approaches to the evaluation of the development of the world system and the social consequences of scientific and technical progress are limited).

Dialectical materialistic substantiation of the systems analysis and systems modeling of global processes stems from the following methodological principles:

- the realization of the conception of the systems nature of the global object as movement from the whole to the part, from the system to the elements;
- the identification of structural levels and the construction of a hierarchy of elements of the system;
- movement from the study of properties to the study of relationships;
- an orientation toward a multiple-model description of a complex global object in the interactive mode;

--the determination of the optimal scale of the system of the model, which is capable of steadily increasing its correspondence to the investigated systems object.

Of course, only an interdisciplinary scientific collective that rationally combines basic and applied research can encompass all these problems in its work.

When we analyze the trends in global modeling, we can note the appearance of more and more elements of a systems nature in this historic form of the traditional method of models. The strict, noninteractive structure of the first global models is giving way to interactive man-machine systems for modeling global development processes, that are being developed in a number of scientific institutions, including the All-Union Scientific Research Institute for Systems Research. The construction and analysis of man-machine models one of the important directions in the further development of systems research, which combines theoretical conceptual and scenario developments with the formal methods and potential of computers in the area of data processing.

Let us further examine three fundamentally important circumstances that most completely express the systems character of global modeling: the dialectical nature of the subject and method of global modeling; the models' closer approximation of the systems complexity of large-scale natural and sionatural objects; the problem of the complete consideration in the models of the social factors of the development of the global system.

METHODOLOGICAL STRUCTURIZATION OF THE OBJECT OF GLOBAL MODELING. The structurization of the object of global modeling is based on the first two principles of systems methodology--movement from the whole to the part (the delineation of elements) and the representation of the object as a multilevel system. The global system is viewed dialectically and the contradictoriness of the trends in global development is analyzed.

The integral system of global contradictions is extremely complex, a multitude of urgent problems, which in turn are combined into groups and systems, are included in it. Society and nature gravitate toward unity, while at the same time a most acute conflict exists between them; peaceloving forces strive for consolidation, for lasting peace, and for peaceful cooperation, but through the fault of imperialist circles the international situation grows worse and the arms race and military confrontation continue; in the leading capitalist countries the conflict between peaceloving forces and the military-industrial complex is increasing; the existence of socioeconomic systems is coming into conflict with the trends toward the growth of international commodity exchange, economic cooperation, and the further internationalization of economic relations; the contradictions connected with the socioeconomic evolution of the developing countries are intensifying: their role in the world is increasing, but the backwardness of their social development is manifested in virtually all measurements of their social life; culture incorporates contradictoriness: on the one hand, it brings people closer together, while, on the other, historically formed cultural orientations may hinder communication, which is especially dangerous in the face of global

problems. However, the profound contradictoriness of the processes of world development does not deny elements of the integrity of the global system, whose fates are inextricably linked to the fate of our planet as a natural whole.

The object of global modeling is a system of interconnected elements with its own specific characteristics. The structurization of an object presupposes not only its examination as a subject, but also the identification of the problems that will be analyzed. The sequential examination of the elements of the object from the standpoint of the research tasks of global modeling makes it possible to identify the set, which is necessary for the analysis of global problems, of subsystems, the development of which determines the progress and course of processes in the global system.

In the aggregate of these subsystems the main role belongs to the questions of securing lasting peace and halting the arms race. These are questions of life or death for the entire global system. Scientific research convincingly proves that a global nuclear strike means the end of civilization and of life itself on earth. On our small planet, which is riddled with countless relationships, no "limited" and "local" nuclear conflicts are possible. But even if international tension does not lead to the most tragic consequences, its inevitable consequences--the arms race, the threat of war, attempts at achieving unilateral military superiority--drastically worsen the conditions for resolving the complex of global problems.

The tasks of protecting the environment and supplying the population with energy and food and the tasks of health care can be accomplished only under conditions of guaranteed equal security and peaceful coexistence and cooperation of all nations and peoples. The halting of the arms race will make it possible to channel vast material resources, human potential, precious raw materials, and natural resources into peaceful activities, into large-scale measures on the ecological restructuring of technology and on the increase of the production of food, and into the needs of education and health care. The solution of global problems, the new version of the CPSU Program stresses, will be substantially facilitated if the squandering of manpower and resources on the arms race is halted.

The economy is another most important subsystem in the modeled global system. Being developed, it satisfies the population's needs according to the rules which are given by the functional management mechanism, utilizing productive capital, natural and manpower resources, and the achievements of scientific and technical progress. The economy is connected with practically all elements of global processes. In particular, it has an enormous influence on the state of the environment and itself experiences the influence of ecological problems, especially the problem of raw materials. The connection between the state of the economy and the militarization of the world is obvious.

The element connected with food production is singled out from the economic subsystem. It depends not only productive capital, manpower resources, and scientific and technical progress, like all other economic elements, but also on limiting factors--the area of cultivated land and natural climatic

conditions. Experts estimate that world food production up to the year 2000 will grow at an average annual rate of 2.2 percent--given a stable climate and on the condition of the use of intensive factors: mechanization, chemicalization, irrigation, that is, factors requiring the expenditure of energy. The Basic Directions of USSR Economic and Social Development for 1986-1990 and the Period to 2000 call for raising the average annual volume of gross agricultural output by 14-16 percent, primarily through intensive factors of development, the introduction of the latest achievements of science, technology, and advanced practice, and the effective utilization of the existing production potential.

Such an element in the global system as the reserves of natural mineral resources, is determined not only by their physical volume, but also by their concentration and accessibility. The cost of extracting and processing resources, which in turn determines the economic advisability of replacing one material by another, depends on this. Therefore, geological forecasts of the conditions of extraction are extremely important here. What is more, the nature resources of the earth (especially energy resources) are unevenly distributed throughout the regions of the world, which influences many other factors: capitalist countries in their quest of cheap raw materials, fuel, and food do not stop short of ravaging the resources of other countries, thereby aggravating the problems of nature conservation and a rational attitude toward it; the attempt to seize sources of raw materials frequently leads to confrontation and outright aggression. In modeling, however, it is necessary to consider not only the demographic, economic, social, and political characteristics of nations, but also their natural resources.

The pollution of the environment, that is, precisely the element of the world system, for which specialists predict the most serious consequences of spontaneous, uncontrolled development (such as "acid rain," the partial destruction of the ozone layer, the increase of the concentration of carbon dioxide in the air, the destruction of the soil, the disappearance of forests, the transformation of significant areas of land into desert, and so forth), is connected in many respects with the extraction and processing of natural resources. Anthropogenic activity also influences the climate, which is also having a significant and most often a negative impact on many natural processes. Until recently experts did not have a unanimous opinion on the dynamics of this element, but most of them anticipate a general warming of the climate.

Scientific and technical progress is a special element in the global system. We know how important its role is for literally all aspects of world development. For modeling it is important that this element, unlike other elements, not be localized. In many economic growth models the pace of economic activity of the population is depicted as a linear combination of the demographic growth rate and the rate of scientific and technical progress. Thus, not only the change in the conditions of the vital activity of man, but also the state of the environment--its influence on the habitat is greater and greater even if the size of the population remains stable--are connected with the rate of scientific and technical progress. The average annual rate of scientific and technical progress can be estimated only after the formulation of hypotheses about its nature. If we consider that the rate of scientific

and technical progress depends on capital investments, it is possible to estimate it--for different countries this estimate will range from 1.5 to 3.5 percent.

The growth of the size of the population, which by the year 2000, according to the latest forecasts, will come to 6.1-6.4 billion in case of an average annual growth of 1.7-1.8 percent, is one of the important problems for the entire global system. Demographic processes are different in different countries and regions of the world, therefore they must be examined by individual regions. The region is an obligatory element of the study of the global system since the system itself is exceptionally diverse and the economic and sociopolitical processes in different regions of the earth are diversified; differences in geological and climatic conditions are also significant.

When studying the population of earth as a global problem, we must not confine ourselves solely to demographic characteristics, that is, to questions of the birth rate, death rate, and the age, sex, and family structures. The means of satisfying the spiritual and material needs of people and these needs themselves depend on class, ideological, and sociopolitical aims, the system of values, and the established norms of behavior, which in turn change under the influence of the development of the mode of production. Therefore, global modeling must view the population not so much as a biological population, but first of all as a socially active force. The social class structure of society is distinguished as an element of the object of modeling. Social processes determine the stability of this structure, the labor activity of the population, and the system of values, while the relationship between classes constitutes the social portrait of society. It is also necessary to consider the occupational and educational structures of the population, the structure of employment, and time budgets.

The social and, consequently, the demographic, ecological, and any other form of the population's activity are to one degree or another regulated by control mechanisms. For different mechanisms--and they differ substantially with respect to goals, methods, and structure in countries with a socialist, capitalist, and mixed economy--different alternate scenarios of development are possible, while in the modeling of global processes it is necessary to single out the element that characterizes the social structure of society.

The very concept "global development" and "global processes" implies close ties and ever-increasing interaction between earth's countries and regions. This is not only the world market and world trade, this is also the exchange of technologies, cultural exchange, the migration of manpower resources, and many other processes. Interregional interaction is an important element in the world system. In the model the relations between countries and regions are realized in terms of it, moreover, the uniting of countries into regions is carried out by the export method or by means of factor analysis.

In examining the structurization of the world system, we enumerated the minimum number of elements here. When an object is described in more detail, their number naturally increases, the basic elements in turn are subjected to structurization, and a detailed hierarchical description emerges. What is

more, in principle it is possible to single out elements of the object of global modeling on other bases.

THE INTERRELATIONSHIP OF GLOBAL PROBLEMS AND THE STRUCTURE OF GLOBAL MODELING. The principles of selecting and classifying global problems have been repeatedly discussed by foreign and Soviet researchers. Here we will examine only the features of the interrelationship of the most important global problems with respect to content and several questions of the systems study of these problems at the theoretical conceptual level and at the level of quantified evaluations.

Global problems are dialectical, they are both a contradiction and an integral systemic unity, they cause mutual aggravation and at the same time contain the potential for reciprocal resolution; modeling should consider that the approach to the solution of one problem may influence the possibilities of solving another. Therefore, in modeling it is necessary to reach a certain optimum that would include contradictory trends in the analysis of the entire set of problems.

In the portion of the problems, which goes back to the most general principles of a systems nature from a formal point of view and permits the use of quantitative indicators, individual problems may express: the imbalance of rates of development of elements in the world system, to which private ownership relations gave rise; the substantial heterogeneousness of this system with respect to certain indicators; the possibility of bringing such indicators closer to critical values, beyond which the system in general or its large subsystems sharply alter the structure. The system is described by two types of indicators.

So-called state variables (or phase variables), which cannot be directly influenced, are grouped with the first type. Controlling influences, which are usually selected within the framework of certain constraints and cannot assume arbitrary values, but vary depending on the goals of the development of the system, are grouped with the second. According to this classification of indicators, scenarios of development are differentiated subject to whether they are constructed in terms of controlling influences or state variables.

Alternative scenarios of long-range interconnected development of countries and regions of the world are used for the preparation of decisions of planning and management organs and recommendations on the selection of optimal strategies of development, for example, in the area of the distribution of resources among sectors of the national economy, their utilization, environmental protection, scientific and technical policy, social programs, and specialization and cooperation in foreign economic relations. When there is a theoretical, logical, or formal apparatus that establishes the interrelations between the two types of scenario, two formulations of the problem are possible.

In one case the scenario in terms of controlling influences, which contains the set of possible alternate variants, answers the question: How will the system develop under the given controlling influences or, in other words, what will the scenario be in terms of state variables. In the other case there is

matched with the given scenario of development of the system in terms of state variables the corresponding scenario in terms of controlling influences. This formulation of the problem is technically far more complex than the first, since it is necessary to find the only possible controlling influences existing within the limits of strict constraints.

Thus, every global problem should not only be connected with various elements of systems modeling, but also be described with the aid of a certain system of scenarios. It is namely in the scenarios that conceptual theoretical studies of global problems are combined with model studies proper, making it possible to take the unformalized aspects of problems into account. Let us cite several examples of possible scenarios in various areas of global problems.

The problem of preserving peace and halting the arms race has a particularly powerful impact on such elements of the world system as population, the habitat (according to the data of specialists the military industry's "contribution" to the total pollution to the environment is 40 percent), interregional interactions, and the economy (approximately 5-6 percent of the gross world product and about 40 percent of all spending on research and development are for military purposes in peacetime). The following scenario is possible here: How will various elements of the global system develop if military spending is reduced annually by 3 percent and the freed funds are transferred to the developing countries in the form of capital investments in the production sphere?

The growth of the size of the earth's population influences the economy, food production, the habitat, and interregional interactions. As a result of uneven demographic growth the correlation between the size of the population of the developed and the developing countries is changing rapidly and new situations are developing in the mechanism of interregional interactions. Here it is possible to study scenarios of active demographic policy in countries with the largest population and scenarios of the international migration of manpower resources.

When we examine the global food problem we can note several factors. If we compare estimates of the growth rate of world food production and population growth, it can be concluded that worldwide per capita food production is growing. But if we pose this problem with a breakdown by regions, considering the fact that developed and developing countries have different possibilities for paying for food, it will turn out that the number of undernourished people is on the rise in some regions. What is more, some capitalist countries that are major food producers are trying to use international trade and the delivery of food as an implement for exerting political pressure. Scenarios of the interaction of the "food production" element and the state of the habitat or with possible changes in climate are of interest for this problem.

The problem of the gap between the levels of economic progress of developed and developing countries can also be studied only by countries and regions. If the gap is greater than tenfold, this will affect not only interregional interactions, but also the spread of scientific and technical progress, because the technologies being developed in the developed countries are geared to a high capital-labor ratio of workplaces and a high professional level of

manpower. Scenarios of financial aid by developed countries to less developed countries and scenarios of specialized scientific and technical aid, which will increase the pace of scientific and technical progress and, accordingly, the economic growth rate of the developing countries, exist for this problem. Here it should be considered that 90 percent of all spending on research and development is presently concentrated in a few highly industrialized countries.

The study of the impact of anthropogenic influences on the habitat is presently in the stage of premodel development and the construction of models, although experts believe that the most serious structural changes threaten precisely the ecology of the earth. Measures of development, which make it possible to keep the system in a state of homeostasis, first of all are necessary for the study of the global ecological problem.

Global problems thus have an interdisciplinary character, dynamic behavior, and a hierarchical structure and contain interconnected elements of various types with various management objectives, some types of information about the object in principle are indeterminate, and many processes are not amenable to formalized description. All these features demand a systems approach to the use of the methods of global modeling—a new technical approach to getting to know the socioeconomic processes of the planet.

Management of the global system urgently poses the problem of decision making. In the systems approach an important role belongs to the ratio of centralization and decentralization. Nobel Prize winner G. Simon names the three basic stimuli of the centralization of the decision-making process: the economies of scale, the coordination of interdependent actions, and the monitoring of lower levels of activity in the interest of the goals of a higher level.

The global problems of modern times clearly require of people a new level of social responsibility, which was emphasized once more by M. S. Gorbachev at a meeting with a delegation of the winners of Nobel Priz winners: "Mankind has now reached such a point when speed is decisive in decisions, weighing, restraint in actions, and consideration of not only one's own national interests, but also the interests of the entire world community are required."⁴

SOCIAL PROBLEMS OF GLOBAL MODELING. The intensification of global problems is closely associated with the contradictory development of scientific and technical progress in today's world. Progress and technology are transforming the world and nature and are contributing to the satisfaction of the growing needs of people, but the irrational utilization of the achievements of science and technology is causing unforeseen negative consequences that are beginning to threaten not only the life of the individual, but the existence of every living thing on earth.

The conflict between negative and positive consequences of scientific and technical progress in the second half of the 20th century has intensified to such a degree that it is evoking the normal concern among the broad masses, politicians, public figures, and scientists, and under the conditions of an

economy based on private ownership it has acquired a threatening nature. Therefore, in the West today a multitude of theories and concepts, which concern the sources of the origin of global problems and crisis situations, difficulties and contradictions of economic growth, and the possibilities and prospects of the development of bourgeois society, are emerging.

In the variegated mosaic of interpretations of global problems one can find both openly apologetic doctrines and radically critical theories. In the former capitalist society is depicted as the ideal of the socioeconomic organization, which has internal reserves for industrial growth and automatically resolves all difficulties, problems and contradictions. The authors of these theories believe that scientific and technical progress has unlimited possibilities for solving any practical and applied problems, including global problems.

Other western authors maintain that the existing trends in the development of mankind are fraught with the most serious consequences and that the underestimation or passive perception of these consequences will lead to a global catastrophe in the immediate future. Here one can find a critical attitude toward modern scientific and technical achievements and references to the nearsighted utilization of science and technology and the ignoring of the social costs that accompany scientific and technical progress.⁵; some researchers see the faults of the capitalist system and the predatory nature of the capitalist mode of production,⁶ others, while rejecting the existing trends in the development of modern bourgeois society, try to justify the capitalist system of management and to reveal its untapped possibilities.⁷ But almost all these works have a common trait--bourgeois authors consider the problems and contradictions of the western world to be global, extending them to all social systems, to all mankind. This is one of the main reasons for the distorted interpretations of global problems and the failure to understand the sources and essence of the global problems of modern times.

In recent years, when mankind has lived under the nuclear threat, when the arms race has proceeded at an unprecedented pace and militaristic propaganda has been launched, the western press has with increasing frequency called global problems "problems of survival." Speaking of the drama of human existence in view of the threat of war, many western scientists emphasize: "We are living in a world that is faced today with the problem of whether or not the human race will be able to survive."⁸ In a matter of minutes, modern mass destruction weapons can wipe cities, countries, and entire regions from the face of the earth and the cumulative nuclear potential is entirely sufficient for man as a biological species to cease to exist forever.

The theoretical scientific elaborations of Marxist scholars graphically show the total perniciousness of a reckless attitude toward the accumulated weapons of mass destruction. The USSR and its allies are in practice waging a struggle to preserve human civilization, by making specific proposals on disarmament, the nonuse of the nuclear potential for military purposes, and the prevention of the militarization of outer space. In the response of M.S. Gorbachev to the appeal from the leaders of the Club of Rome it is stated that "the problems of war and peace unquestionably occupy a foremost place among present international problems, since they have a direct bearing on the

preservation of human civilization and life on earth."⁹ Such an understanding of global problems opens the way to the constructive solution of the problems of the modern world under the conditions of detente and international cooperation.

But, of course, one must not reduce all global problems just to the "problem of survival," as do certain western authors who conclude that mankind is moving toward an inevitable global catastrophe, that uncontrollable scientific and technical progress, by causing the militarization of the world, threatens human existence. The cause of the origination of global problems, in their view, lies precisely here, and for this very reason they are practically unsolvable.

Such an untenable approach to the analysis of the causes of the origination and nature of global problems, which does not conform to the scientific understanding of the essence of global problems, noticeably reduces the social significance of foreign global projects. This is manifested with particular clarity in projects carried out on the orders of the Club of Rome--a nongovernmental organization which emerged in the early 1970's, calling the attention of the world community to global problems; the procedural questions on the construction of computer models of global development were also been elaborated under its aegis. The 10th report to the Club of Rome--"Roads to the Future," which particularly noticeably reflected the ideological errors of western globalistics, was subjected to thorough critical analysis in Soviet literature.¹⁰

But in some western global projects, occasionally regardless of the desire of their creators, the antagonistic contradictions of capitalist society come to light. Such was the case with the 11th report of the Club of Rome ("For Good or Bad?" which was devoted to the social aspects of microelectronics and concerned the contradictions between technical progress and employment under the conditions of private-property social relations.

Back in December 1981 at the international symposium "The Forecasting of Science and Human Needs," which was held in Tbilisi on the initiative of UNESCO, in the report by A. King, president of the Club of Rome and one of the editors of the 11th report, "The Social Consequences of Microprocessors," and the report of American scientist R. Oyres, "Long-Range Prospects of the Introduction of Robots," it was stated that robots and microprocessors are a challenge to western civilization and are checking it for adaptability to this revolutionary technological innovation which threatens developed capitalist countries with a sharp increase in unemployment. The intensive decrease of the cost of the microprocessors installed in robots is arousing particular alarm of western authors. C. Norman, for example, in speaking about the "microprocessor revolution," concludes that "automation promises to raise productivity, but threatens thousands of workplaces."¹¹ Under the conditions of the contradictions of the capitalist mode of production it is hardly possible to solve the employment problem satisfactorily.

As to socialist society, here these problems are acquiring a fundamentally different sound. Automation and robotization do not carry the threat of unemployment, but rather signify an appreciable increase of the share of creative

labor. The policy of the acceleration of socioeconomic development and the utmost intensification and increase of the efficiency of production urgently requires the retooling of the national economy. In the Basic Directions of USSR Economic and Social Development for 1986-1990 and the Period to 2000 it is outlined to introduce automated systems in various spheres of production, to increase the level of automation by approximately twofold, to increase the scale of use of advanced high-performance computers of all classes, to develop flexible adjustable machine systems and computer-aided design systems, automatic lines, machines and equipment with built-in microprocessors, multifunction NC machine tools, robotic, rotary, and rotary conveyor complexes. The new version of the CPSU Program envisages the carrying out of the robotization and computerization of production on an ever broader scale and names microelectronics, computer technology, and the information industry among the priority directions and true catalysts of scientific and technical progress.

In socialist society robotization and the introduction of microprocessors are carried out in humane forms. Of course, its own problems of the optimization of the interaction of man and cybernetic devices and problems of an economic, social, and psychological order will also arise here. Will video terminals, following television, harm human intercourse? Will pupils equipped with calculators forget how to perform calculations independently? Will the new modes of communicating information lead to "information dependency," to the impoverishment of the individual? All these possible consequences require careful prognostic research and a reliable system of social and cultural control.

Microprocessor equipment and complex advanced technology can help mankind in solving many technical, economic and social problems. It is important to realize that a society, which is based on socialist principles and uses advanced technology and information techniques can develop as a society in which people will find the highest satisfaction in creative labor.

Possibilities of the constructive resolution of the difficulties and contradictions, with which mankind was faced, are being afforded in the direction of the uniting of the efforts of all progressive and democratic forces. In calling for their consolidation, Marxist-Leninists believe that the emergence of global problems is not chance occurrence and not fatally predetermination, which dooms people. Global problems stem from the objective processes of the development of mankind, global problems are a reality that should be reckoned with by people who are transforming the natural and social conditions of their existence.

Rapid scientific and technical progress and the global problems of modern time require of people a new level of social responsibility. Mankind should create a unified set of ethical values at the global level, which will determine its attitude toward nature, toward the social organization of life, and toward itself and a system that eliminates war from the life of society. Only the specific moral values of creativity and the renunciation of war will give mankind the feeling of historical optimism, which is necessary for accomplishing the unprecedented tasks of our time.

FOOTNOTES

1. "Programma Kommunisticheskoy partii Sovetskogo Soyuza. Novaya redaktsiya. Prinyata XXVII syezdom KPSS" [The Program of the Communist Party of the Soviet Union. The New Version. Adopted by the 27th CPSU Congress], Moscow, 1986, p 82
2. See D.M. Gvishiani, "Methodological Problems of the Modeling of Global Development," VOPROSY FILOSOFII, No 2, 1978; D.M. Gvishiani, "Dialectics, Systems Orientation, and Global Modeling," VOPROSY FILOSOFII, No 5, 1983; "Sotsiologicheskiye aspekty globalnogo modelirovaniya. Sbornik trudov VNII sistemnykh issledovaniy" [Sociological Aspects of Global Modeling. Collection of Works of the All-Union Scientific Research Institute of Systems Research], No 6, Moscow, 1980; "Modelirovaniye protsessov globalnogo razvitiya. Sbornik trudov VNII sistemnykh issledovaniy" [The Modeling of Processes of Global Development. Collection of Works of the All-Union Scientific Research Institute of Systems Research], No 8, Moscow, 1979; "Sistemniye modelirovaniye protsessov globalnogo razvitiya. Sbornik trudov VNII sistemnykh issledovaniy" [The Systems Modeling of Processes of Global Development. Collection of Works of the All-Union Scientific Research Institute of Systems Research], No 14, Moscow, 1980; V.V. Zagladin and I.T. Frolov, "Globalnyye problemy sovremenности: nauchnyy i sotsialnyy aspekty" [Global Problems of Modern Times: Scientific and Social Aspects], Moscow, 1981; G.Kh. Shakhnazarov, "Gryadushchiy miroporyadok" [The Future World Order], Moscow, 1981; "Globalnyye problemy sovremennosti" [Global Problems of Modern Times], Moscow, 1981; "Cheleveko-mashinnaya sistema modelirovaniya protsessov globalnogo razvitiya. Sbornik trudov VNII sistemnykh issledovaniy" [The Man-Machine System of the Model of Processes of Global Development. Collection of Works of the All-Union Scientific Research Institute of Systems Research], Moscow, 1982; V. M. Leybin, "'Modeli mira' i obraz cheloveka: kriticheskiy analiz idey Rimskogo kluba" ['Models of the World' and Man's Image: A Critical Analysis of the Ideas of the Club of Rome], Moscow, 1982; "Marksizm-leninizm i globalnyye problemy sovremennosti" [Marxism-Leninism and Global Problems of Modern Times], Nos 1, 2, Moscow, 1983; "Globalnoye modelirovaniye: sotsialnyye protsessy. Trudy seminara VNII sistemnykh issledovaniy" [Global Modeling: Social Processes. Proceedings of a Seminar of the All-Union Scientific Research Institute of Systems Research], Moscow, 1984; "Protsessy globalnogo razvitiya: modelirovaniye i analiz. Sbornik trudov VNII sistemnykh issledovaniy" [Global Development Processes: Modeling and Analysis. Collection of Works of the All-Union Scientific Research Institute of Systems Research], Moscow, 1984; "Sistemnyy analiz protsessov globalnogo razvitiya. Sbornik trudov VNII sistemnykh issledovaniy" [Systems Analysis of Global Development Processes. Collection of Works of the All-Union Scientific Research Institute of Systems Research], Moscow, 1985.
3. See: "The Computer Age: A Twenty-Year View," New York, 1981, p 226.
4. PRAVDA, 14 November 1985.

5. See Ya. Tinbergen, "Peresmotr mezhdunarodnogo poryadka" [A Reexamination of International Order], Moscow, 1980, p. 104.
6. See J. Peagin, "Social Problems: A Critical Power Conflict Perspective," New York, 1982, p 374.
7. See: "Through the 80's: Thinking Globally. Acting Legally," Washington, 1980, p 215.
8. "What Kind of World Are We Learning Our Children?," Paris, 1979, p 31.
[as published]
9. IZVESTIYA, 26 October 1985.
10. See: V.V. Zagladin et al., Op. cit., pp 182-190.
11. C. Norman, "The New Industrial Revolution," THE FUTURIST, January 1981, p 36.

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AWARDS AND PRIZES

UKRAINIAN STATE PRIZES IN SCIENCE, TECHNOLOGY FOR 1985

Kiev VISNYK AKADEMIYI NAUK UKRAYINSKOYI RSR in Ukrainian No 5, May 86
pp 94-106

[Article under the rubric "Chronicle and Briefs": "Scientists of the Ukrainian Academy of Sciences Are the 1985 UkSSR State Prize Recipients in Science and Technology"]

[Text] The working people of the Soviet Union have successfully completed the year 1985. Additional success has been achieved in the further development of the national economy, science and culture, and in increasing the prosperity of the people.

The scientists of the Ukrainian SSR labored selflessly alongside all other working people.

Many scientific research projects, including those of scientists with establishments of the UkSSR Academy of Sciences, have been honored with a Ukrainian SSR State Prize in Science and Technology.

A 1985 Ukrainian SSR State Prize has been awarded to the following members of the UkSSR Academy of Sciences:

--Anatoliy Mikhaylovich Samoylenko, corresponding member of the UkSSR Academy of Sciences, department chairman at Kiev State University imeni T.G. Shevchenko--for the series of works "Methods of Investigating Periodic and Quasi-Periodic Oscillations."

--Doctor of Physical Mathematical Sciences Leonid Andreyevich Pastur; Candidate of Physical Mathematical Sciences Sergey Andreyevich Gredeskul, senior scientific associate of the Physical Technical Institute of Low Temperatures of the UkSSR Academy of Sciences; Ilya Mikhaylovich Lifshits, academician of the USSR Academy of Sciences and UkSSR Academy of Sciences (posthumously)--for the monograph "Vvedeniye v teoriyu neuporyadochennykh sistem" [Introduction to Theory of Disordered Systems], which was published in 1982.

--Academician of the UkSSR Academy of Sciences Maksim Fedotovich Guliy, department head of the Institute of Biochemistry imeni A.V. Palladin of the

UkSSR Academy of Sciences, project coordinator; Doctor of Biological Sciences Dmitriy Alekseyevich Melnichuk, laboratory director at that same institute, rector of the Ukrainian Agricultural Academy--for the development of methods of controlling and regulating biosynthetic processes in the organism and adoption of methods of boosting productivity of agricultural livestock created on the basis of these methods.

--Doctor of Technical Sciences Boris Sergeyevich Stogniy, department head of the Institute of Electrodynamics of the UkSSR Academy of Sciences, project coordinator; Doctor of Technical Sciences Igor Museyevich Syrota, scientific consultant; Candidate of Technical Sciences Yevgeniy Nikolayevich Tankevich, senior scientific associate; Candidate of Technical Sciences Vladimir Alekseyevich Chernenko, department head; Candidate of Technical Sciences Vladislav Vasilyevich Rogoza, chief engineer of the Special Design and Technological Bureau, staff members of this institute--for the elaboration of a theory of the principles of structure and the development on the basis of these principles of a new generation of measuring current converters for modern power systems.

--Academician of the UkSSR Academy of Sciences Valentin Nikiforovich Yeremenko, department head; Doctor of Chemical Sciences Georgiy Mikhaylovich Lukashenko; Candidate of Chemical Sciences Aleksandr Sergeyevich Bolgar, director of laboratories; Stanislav Petrovich Gordiyenko, Vladislav Romanovich Sidorko, and Boris Vasilyevich Fenochka, candidates of chemical sciences and senior scientific associates of the Institute of Problems of Material Science of the UkSSR Academy of Sciences--for the series of works "Research on the Chemical Thermodynamics of Metal Alloys and Refractory Compounds."

--Valeriy Andreyevich Kozhema, deputy department head of the Institute of Electric Institute imeni Ye.O. Paton of the UKSSR Academy of Sciences--for the development and introduction of industrial methods of installing steel technological pipelines at industrial construction projects in the Ukrainian SSR.

The Series of Research Papers on Periodic and Quasi-Periodic Oscillations

Members of the Department of Integral and Differential Equations at Kiev State University imeni T.G. Shevchenko have published a series of papers dealing with methods of investigating periodic and quasi-periodic oscillations, which was awarded a Ukrainian SSR State Prize.

This series includes four monographs, which examine complex, crucial problems of qualitative theory of differential equations and nonlinear mechanics. The authors belong to the well-known Kiev school of mathematical physics and nonlinear oscillations. The recipients include the department chairman, Corresponding Member of the UkSSR Academy of Sciences Anatoliy Mikhaylovich Samoylenko.

This scientist's original, deep-probing research on the problem of creating and developing methods of investigating periodic and quasi-periodic oscillations in processes, the mathematical models of which are described by differential equations, is a continuation of basic research in this area by H.

Poincare, A.M. Lyapunov, M.M. Krylov, M.M. Bogolyubov, A.M. Kolmogorov, Yu. Mozer, and other eminent Soviet and foreign scientists.

Back in 1934 M.M. Krylov and M.M. Bogolyubov proposed a method of sequential substitutions, which is an effective means of solving a great many interesting problems in nonlinear mechanics. In particular, this method was used to solve the problem of the existence of quasi-periodic conditions with two principal frequencies in nonlinear oscillating systems. Approximate solutions obtained in the general case, however, contained noncoinciding sequences. Recently, in connection with the appearance of studies by A.M. Kolmogorov and V.I. Arnold, M.M. Bogolyubov modernized the method of sequential substitutions, as a result of which agreement of corresponding distributions is ensured.

Thanks to this method, A.M. Samoylenko succeeded in obtaining a number of important results in nonlinear mechanics: investigation of the behavior of trajectories on a torus of more than two dimensions in a case where the functions which define the torus are not analytical but have a sufficient number of derivatives; proving a theorem on the reducibility of a system of differential equations with a quasi-periodic continuous right-hand member specified on an n-dimensional torus to a pure inversion, and also the fact that the majority of fairly continuous systems on a torus which are close to its customary winding are reduced to it by substitution of coordinates, which is subject to differentiation.

Important results have been obtained in investigation of the reducibility of linear systems of differential equations with quasi-periodic coefficients to linear systems of differential equations with constant coefficients. Of course such systems with a small right-hand member have also been examined in the past with asymptotic methods of nonlinear mechanics, but the obtained distributions were of an asymptotic character and showed discrepancies as a consequence of the presence of "small divisors." Precisely for this reason the reducibility of a linear system with quasi-periodic coefficients could be examined exclusively in an asymptotic sense.

Utilizing the method of accelerated agreement, A.M. Samoylenko achieved reducibility of a linear system with quasi-periodic coefficients with the aid of a reduction matrix, which is expressed by rapid-coincident series, and proved a theorem on the degree of reduced systems in the analytical and differentiable instances, which formed the basis of metric investigations of differentiable dynamic systems.

We shall note results obtained in studying the behavior of integral curves of a nonlinear system of differential equations with a quasi-periodic right-hand member with a differentiable invariant toroidal polytype, as well as a differentiable compact polytype for a non-self-contained system amenable to differentiation. This scientist proved theorems on reducing such systems around invariant polytypes to linear systems of differential equations.

Anatoliy Mikhaylovich also developed a numeric-analytic method of investigating periodic solutions of nonlinear systems of differential equations. This method provides an algorithm for obtaining such solutions in the form of a uniformly corresponding sequence of periodic functions and makes

it possible, proceeding from the functions of this sequence, to reach a conclusion on the existence of periodic solutions. Important applied problems of physics and technology were studied in this manner: forced periodic oscillations of a pendulum affected by periodically repeating impulses; harmonious rotational oscillations of a shaft formed of two masses connected by a nonlinear flexible linkage, one of which is acted upon by sinusoidal torque; turning-oscillatory motions of a double pendulum with a vibrating suspension point were investigated, and so on.

A.M. Samoylenko's scientific achievements are widely known both in this country and abroad. They are extensively utilized in training young, highly-skilled specialists in theory of oscillations and are helping to consolidate the international prestige of Soviet science and to strengthen its vanguard position.

Award of a UkrSSR State Prize to A.M. Samoylenko is evidence of the importance and relevance of the results he has achieved.

Academician Yu.A. Mitropolskyy

Theory of Disordered Systems

The natural sciences, particularly physics, are exerting enormous influence on modern society. Of course advances in science promote improvement in living conditions. But this unquestionably important reason is not the only one affecting such influence. Today scientific activity constitutes one of the means of realizing man's profoundly inherent aspiration to gain knowledge of and to elucidate nature, to form a scientific philosophical outlook and perception of the world at each stage of man's existence.

These two factors are connected with division of branches of science into basic and applied. We should note that basic science proper is increasingly branching into two directions.

One of these is research directed toward utilization (in the broadest meaning of the word) of existing ideas and principles and toward obtaining on the basis of these ideas and principles diversified results, frequently very substantive, important, and hard-won. This part of basic science on the one hand is drawing closer to applied science, while on the other hand its aim is to describe as broad a range of phenomena as possible, to increase and make our knowledge of nature as complete as possible. Thus a movement "in breadth," so to speak, is a characteristic trend of this direction taken by basic science.

The other direction is characterized first and foremost by movement "in depth." Its main goal is to elucidate and gain knowledge of the fundamental (as a rule not too numerous) laws, principles, and relationships on which phenomena are based. Precisely this direction taken by basic science, which could be called conceptual, plays a decisive role in forming a scientifically-substantiated understanding of nature.

It is important to emphasize that such an understanding can be the result both of discovery of new laws and phenomena and awareness of the fact that new classes of phenomena and matter can and should become the focus of fruitful scientific investigation. While the former is typical, for example, of physics of elementary particles and astrophysics, the latter is very frequently employed in physics of a condensed state. In particular, the emergence and development of physics of disordered systems occurred precisely in this manner. It is true that up to the mid-1950's essentially all investigations in physics of a condensed state involved ideally ordered substances. And it was only as a result of the pioneer efforts of such scientists as P. Anderson, A. Lifshits, and N. Mott, and the stream of research evoked by them that it became understood that disordered systems, that is, substances which are not marked by a far-reaching structural order, constitute an extraordinarily interesting subject of investigation in physics.

Today disordered systems -- amorphous and glasslike semiconductors, metallic, dielectric, and magnetic glasses, high-alloy low-dimensional systems, insular films, etc -- are increasingly more extensively being utilized in the most varied branches of basic and applied science (solid-state electronics, radiophysics, optics, physics of superconductivity). They are employed in making memory elements for electronic computers, solar batteries and TV equipment, lasers and thermoelectric devices. A large group of problems connected with comprehensive study and extensive utilization of disordered substances constitutes an important area of solid-state physics which is experiencing vigorous development. Growing practical demand for new industrial materials with a predetermined combination of physicochemical properties presents condensed-state theory with the task of developing a detailed and complete picture of the structure and properties of disordered solids, which is extremely necessary in order to accomplish this complex task.

The monograph "Vvedeniye v teoriyu neuporyadochenykh sistem," which was awarded a Ukrainian SSR State Prize in Science and Technology, deals with basic questions in this branch of physics. It summarizes the results of many years of investigations in theory of disordered systems performed in the Ukraine, chiefly by members of the noted Kharkov school of theoretical and mathematical physics. The authors include Academician of the USSR and UkrSSR Academies of Sciences I.M. Lifshits, one of the founders of the theory of disordered systems, who for many years headed research on solid-state theory in this country (he was awarded the prize posthumously), as well as his students and colleagues, well-known specialists and senior scientific associates of the Physical Technical Institute of Low Temperatures of the UkrSSR Academy of Sciences Doctor of Physical Mathematical Sciences L.A. Pastur and Candidate of Physical Mathematical Sciences S.A. Gredeksul.

The core of the monograph comprises results of the authors' basic research papers, many of which became classics and initiated entire new directions in contemporary theory of disordered systems. The prize recipients formulated and extensively utilized two of the most important general principles of the theory: spatial uniformity on the average and an absence of correlations between the values of the random parameters which characterize the disordered state at points infinitely distant from one another. They identified a class of self-averaged physical quantities for which experimentally-observed values

are reliable within macroscopic boundaries, ensuring reproducibility of measurement results, and which coincide with calculated average values.

The monograph proposes and studies in detail a number of precisely resolved models of one-dimensional disordered systems. For the first time the fact of localization of all states in one-dimensional disordered systems is rigorously proven, and a comprehensive analysis made of the various properties and phenomena which arise in such systems as a consequence of the above-mentioned fact--the most radical difference between disordered and ordered systems. An effective general method has been developed for investigating the structure of the states of one-dimensional systems, which employs the ideas of nonlinear mechanics, and a number of dynamic and kinetic characteristics (density of states, average Green's function, conductivity, dielectric constant) of one-dimensional quasi-one-dimensional systems--a large class of objects which have been intensively investigated in recent years--were calculated with the aid of this method.

The fluctuation region is the most typical region of the spectrum of elementary excitations in disordered systems. Here all states are localized with any dimensionality of space, and this region's contribution to the forming of the physical characteristics of disordered systems essentially determines all their important new properties. To the authors of this monograph goes the credit for isolating and investigating this region of the spectrum. They proposed a classification of the principal types of random potentials which take part in the forming of the effective potential in the fluctuation region and for each of these types studied the form of fluctuations, the wave functions of the principal state, and the density of states, which made it possible exhaustively to describe the fluctuation region of the spectrum.

The authors constructed a consistent theory of distribution of additive physical quantities by degrees of concentration of alloying elements. They examined modified and self-consistent variants of such a distribution, which have since experienced considerable development and are used as an effective tool for analyzing a broad range of phenomena (electron, phonon, magnetic, exciton) in disordered substances of the most diversified nature.

An unusually substantial model of the theory was proposed--a model of structural disorder with dispersion points (Lifshits model). A comprehensive examination of the alloying element zone which develops due to erosion of the local alloying element level was performed within the framework of this model, and all the zone's principal spectral characteristics were determined.

A theory of passage of particles and waves through random-heterogeneous layers was constructed. Two types of energies were identified, in each of which passage is of a significantly differing character--resonant and nonresonant. The complex statistical nature of a layer's transparency was investigated, and the properties of disordered samples of finite dimensions were analyzed for the first time based on this transparency.

The methods developed in the monograph and the presented results have won universal recognition. Many of them (although it has been less than four

years since the monograph was published) have already been utilized in the most diversified areas of physics --in studying the properties of noncommensurable systems and disordered magnetic materials, wave propagation in random media and random impulses in ideal systems, in theory of biopolymers and theory of tunnel phenomena etc. The theoretical analysis performed in the monograph has made it possible to make specific practical recommendations, for example, pertaining to selection of optimal dimensions and operating conditions for thin-film elements of semiconductor devices. On the other hand, development of the mechanism of this theory has led to the creation of a new area of mathematical physics--spectral theory of random operators.

This prize-winning monograph constitutes an unusually integral and well-conceived presentation of the present state of this theory, including its links with a number of adjacent sciences. For the first time in the world literature, the system of theoretical notions and concepts of the physics of disordered systems has been formulated as an independent area of theoretical physics with characteristic profound and universal concepts and unique mechanism. This monograph has already exerted and unquestionably will continue to exert significant influence on development of this new branch of physics, which is developing rapidly at the present time, opening up ways to solve many basic as well as practical-importance problems of physics and technology of disordered systems. Award of a UkSSR State Prize constitutes appropriate recognition of this outstanding scientific achievement.

Academician of the UkSSR Academy of Sciences B.I. Verkin

Preparations for Animal Husbandry

For study of the mechanisms and development of a method of controlling and regulating biosynthetic processes in the organism, as well as adoption of a means of increasing productivity of agricultural livestock based on this method, a UkSSR State Prize in Science and Technology has been awarded to a group of scientists, including prominent biochemists--Academician of the UkSSR Academy of Sciences M.F. Gulyy, head of the Department of Biosynthesis and Biological Properties of Protein of the Institute of Biochemistry imeni A.V. Palladin of the UkSSR Academy of Sciences, and Professor D.A. Melnichuk, director of the department's regulation of substance metabolism laboratory and rector of the Ukrainian Agricultural Academy.

It is known that carbon dioxide performs an important regulatory function in respiratory processes and in maintaining a constant concentration of hydrogen ions in the blood and other biological fluids in animals and man. But recently other pathways of carbon dioxide involvement in substance metabolism have also become known. It has been determined that carbon dioxide in the tissues both of heterotrophic and autotrophic organisms is utilized in principal biosynthetic processes with the participation of so-called carboxylation reactions, and is also an important regulatory factor in the activity of many enzymic systems, the functions of certain endocrine glands, glands related to digestive processes, etc.

As indicated by the research done by M.F. Gulyy, D.A. Melnichuk, and their colleagues, intensity of biosynthesis of substituted amino acids, purine and pyrimidine nucleotides, carbohydrates, and higher fatty acids is in direct relation to the concentration and intensity of fixing of carbon dioxide in the tissues (processes of carboxylation).

Proceeding from these data, the team headed by the prize recipients developed workable, simple, and fairly effective ways of influencing the intensity of the processes of carboxylation and biosynthesis of the principal organic compounds of the tissues of the organism. This was achieved by increasing in the tissues the concentration of carbonic acid (bicarbonates and CO₂) as the immediate substrate of carboxylation reactions, as well as ions of magnesium, manganese, and zinc -- natural activators of carboxylases. The authors used this phenomenon as a basis in developing a special preparation, "carboxyline," which contains sodium bicarbonate (as a source of HCO₃⁻) and sulfate salts of the above-named bivalent metals. It was demonstrated in experiments using this preparation as well as its individual components that intensity of biosynthetic processes increases commensurate with increase in intensity of carboxylation reactions. Since productivity of livestock is determined by the intensity of biosynthetic processes in their organism, this enabled the authors to develop a fairly effective method of increasing productivity in cattle and other livestock by 10-20 percent without additional consumption of feed (that is, solely by improving utilization of the nutrient substances in feed) and to obtain an additional 12 rubles worth of livestock products on the average for each ruble of expenditure connected with the production and utilization of "carboxyline."

In recent years it has been determined in the scientific subdivisions headed by M.G. Gulyy and D.A. Melnichuk that the intensity of the processes of recovery of ammoniated nitrogen in the organism is also in direct relation to the intensity of fixing of carbon dioxide (carboxylation). This fact, which is of great theoretical significance, was utilized to develop a method of increasing the effectiveness of utilization of nonprotein nitrogen substances consumed by ruminants as protein substitutes. Two new mineral-ammonia preparations (MP-15 and MP-30) have been developed. Study of these preparations when feeding cattle on pulp residues and silage, and subsequently full-scale production testing of the results of experiments on a large number of animals demonstrated that they significantly increase utilization of the nutrient substances in feeds and ammoniated nitrogen by animals and boost the average daily weight increase by an average of 100-250 grams. The protein deficit in feeding is made up by 15 and 30 percent respectively with preparations MP-15 and MP-30.

The authors of the prize-winning research have done a fine organizational job of adopting the obtained results in animal husbandry in the Ukrainian and Moldavian SSR as well as in a number of oblasts of the RSFSR. In these republics the two preparations are now in production at 40 feed mix concentrate plants and specialized shops. Annual consumption of these preparations has recently reached a rate of 25-28 thousand tons in the Ukrainian SSR alone, which means savings of 20-25 million rubles. In 1985 USSR Gosagroprom is planning a substantial increase in production and utilization of these preparations in the RSFSR and other republics, which will

increase the contribution made by this research project toward accomplishing the tasks of the Food Program.

Corresponding Member of the UkrSSR Academy of Sciences V.D. Romanenko

Candidate of Biological Sciences M.G. Zhuravskiy

New Power-System Measuring Current Converters

Our country's energy requirements double every 10-15 years. Possibilities of extensive growth of electric power, that is, increase in weight, size, and creation of basic equipment inventory, are virtually exhausted. This prompts intensification of secondary electric power engineering systems--relay protection, control, regulation of measuring and monitoring, which with minimal expenditures ensures a substantial increase in reliability, quality, and economy of operation of primary electric power systems and installations.

Efficient functioning of protection, automatic systems and control is determined first and foremost by the degree of sophistication of information sensors--measuring current converters (VPS), which until recently have been traditionally designed as current transformers with closed ferromagnetic magnetic circuits and operated only in static conditions with sine-wave current. However, in connection with increase in the unit output capacities of power installations and the operational adoption of superhigh- and ultrahigh-voltage system power transmission lines, the operation of VPS became considerably more complex, with considerably increased requirements on operating precision. Damage avoidance time in modern power systems is such that VPS must furnish information to protection and automatic control systems in conditions of intensive transient processes. A lack of VPS with standardized metrologic characteristics in dynamic conditions and with non-sine-wave currents makes it impossible to develop sophisticated, highly-efficient relay protection and automatic control devices, which has in some measure hampered development of the electric power industry.

A new approach to solving this problem, which is important to the economy, was essential. And such an approach was found by the people at the Institute of Electrodynamics of the UkrSSR Academy of Sciences, working jointly with organizations of the USSR Ministry of the Electrical Equipment Industry--the All-Union Scientific Research Institute for Transformer Engineering, and the High-Voltage Equipment Plant in the city of Zaporozhye.

A team of scientists and production people was awarded a Ukrainian SSR State Prize in Science and Technology for development of theory, principles of design, and development on the basis of these principles of a new generation of measuring current converters for modern electric power systems. Prize winners include the project manager, Doctor of Technical Sciences Boris Sergeyevich Stogniy, department head of the Institute of Electrodynamics of the UkrSSR Academy of Sciences; Doctor of Technical Sciences Igor Museyevich Syrota, scientific consultant; Candidate of Technical Sciences Yevgeniy Nikolayevich Tankevich, senior scientific associate; Candidates of Technical Sciences chief engineer Vladislav Vasiliyevich Rogoza and department head

Vladimir Alekseyevich Chernenko, staff members of the institute's Special Design and Technological Bureau.

Basic research in the area of electric measuring converter equipment has been conducted at the institute during the last 15 years under the direction of B.S. Stogniy. The new generation of VPS is a result of development of theory of static and dynamic current converters.

Methods of physical and mathematical modeling were devised, which made it possible comprehensively to investigate electromagnetic VPS, taking into consideration the indeterminacy of the curve of magnetization of their ferromagnetic cores. In addition to determined models, it was proposed that mathematical probability models of VPS be developed, on the basis of consideration of the quasi-determined and random nature of input signals.

The obtained results make it possible to determine the accuracy characteristics of any VPS throughout the entire actually-existing range of input currents and voltage.

Design and development of VPS with standardized characteristics in dynamic operating conditions required a great deal of research in the area of design, metrological and engineering support. Methods of synthesizing electrical circuits were developed. The problem of parametric optimization of VPS was solved as a problem of precision synthesis, and it was formalized taking into account the multifunctionality of VPS. Optimization of design and production parameters indicated that utilization of high-grade cold-rolled steels makes it possible, all other conditions being equal, to reduce the VPS magnetic circuit cross section in comparison with hot-rolled steels.

Important problems of engineering support were resolved on the basis of the relationship between quality criteria and probability characteristics of design and engineering parameters and the utilized materials: standards and tolerances were determined for putting VPS into series production, and tolerances were optimized taking practical experience into account.

Metrological support for manufacture of new VPS and a unique method of determining current transformer deviations in transient conditions were worked out, on the basis of which a method of synthetic testing was proposed; it was approved by the USSR State Committee for Standards and issued as the official method for testing VPS. A test stand was designed and built for synthetic testing of current transformers in transient conditions. The test stand equipment was certified by the USSR State Committee for Standards as a standard measurement procedure, which makes it possible to determine VPS errors with transient currents to 80 ka and virtually any attenuation time constant.

These scientists reached a solution to a unique scientific and technical problem for the first time anywhere in the world--they designed VPS with excellent standardized metrological characteristics not only in static but also in dynamic conditions, including VPS for the Ekibastuz-Urals power transmission line, the world's first ultrahigh-voltage industrial power transmission line.

The scientific research and experimental design project to develop new, technically sophisticated VPS, carried out by the UkrSSR Institute of Electrodynamics jointly with scientists at the All-Union Scientific Research Institute for Transformer Engineering and the Zaporozhtransformator High-Voltage Equipment Plant, is an important component part of the power program and ensures accomplishment of national plans regarding power supply to large regions of our country and the forming of ultrahigh-voltage system power transmission lines.

This project was carried out within the framework of the synthesizing scientific and technical programs of the USSR State Committee for Science and Technology pertaining to establishment and further development of this country's unified power system, in conformity with the plans of a number of branches and ministries, particularly the USSR Ministry of Power and Electrification, Ministry of the Electrical Equipment Industry, and the State Committee for Standards.

Academician of the UkrSSR Academy of Sciences A.K. Shidlovskiy

Research in the Area of Chemical Thermodynamics of Metal Alloys and Refractory Compounds

A purposeful approach to the development of materials with prescribed properties is impossible without knowledge of the fundamental thermodynamic characteristics and their interrelationship with the structure of matter. Study of the thermodynamic properties of alloys and metal-like compounds is essential for proving existing and developing new metallurgical processes, for selecting efficient operating conditions for synthesizing materials and optimal conditions of their utilization, and for obtaining new composite materials. At the same time thermodynamic properties are also of fundamental significance from a cognitive point of view; they constitute a quantitative indicator of the interatomic interaction of constituents in alloys and compounds and essentially define the nature of phase equilibria and its evolution during change in external conditions.

Back at the beginning of the 1950's, at Kiev State University and the Laboratory for Special Alloys of the UkrSSR Academy of Sciences, V.N. Yeremenko performed the first experimental work in the Soviet Union pertaining to study of the thermodynamic properties of metal alloys, which subsequently experienced extensive development at the Institute of Problems of Material Science of the UkrSSR Academy of Sciences. Extensive experimental investigation of the thermodynamics of the formation of alloys in binary metal systems was conducted under the immediate direction of this scientist, investigations which made it possible substantially to extend the arsenal of reliable standard reference data on the thermodynamics of metal solid solutions, melts, intermeallides, carbides, silicides, and other metal-like compounds. The principal mechanisms of the thermodynamics of alloy formation in relation to the metallochemical parameters of the constituents and the nature of their interaction in the system has been established, and the specific features of thermodynamics of alloys based on transition metals were determined.

A group of staff members at the Institute of Problems of Material Science of the UkrSSR Academy of Sciences was awarded a Ukrainian SSR State Prize in Science and Technology for the series of works "Investigations in the Chemical Thermodynamics of Metal Alloys and Refractory Compounds." The prize winners include Academician of the UkrSSR Academy of Sciences Valentin Nikiforovich Yeremenko, department head; laboratory directors Doctor of Chemical Sciences Georhiy Mikhaylovich Lukashenko and Candidate of Chemical Sciences Aleksandr Sergeevich Bolgar; senior scientific associates Candidates of Chemical Sciences Stanislav Petrovich Gordiyenko, Vladislav Romanovich Sidorko, and Boris Vasilevich Fenochka.

The principal area of G.M. Lukashenko's scientific research is study of the thermodynamic properties of alloys of transition metals in the solid and molten state at elevated temperatures. Unique methods were developed and the thermodynamic properties of melts for a number of systems based on 3d-transition and rare-earth metals were determined with his participation. Together with V.R. Sidorko he designed and built a set of equipment for measuring the electromotive force of galvanic cells, which made it possible to investigate the thermodynamic functions of the forming of metal solutions, intermetallic and metal-like compounds. Study of alloys of transition metals made it possible to establish the relationship between the thermodynamic characteristics of alloys and the properties and electron structure of their constituents, their place in the Periodic System, and the structural features of the phases.

A.S. Bolgar, S.P. Gordiyenko and B.F. Fenochka devote considerable attention in their investigations to the thermodynamic properties of compounds and determination of their dependence on type of chemical bond. These investigators developed methods of determining the thermodynamic characteristics of refractory compounds by calorimetric methods, by measurement of vapor pressure and high-temperature mass spectrometry. They established enthalpies and specific heats in broad temperature ranges, types of vaporization reactions, vapor composition and pressure, and the energy characteristics of the strength of the chemical bond of compounds of transition and rare-earth metals with elements of groups III-VI. These scientists devised methods of calculation and approximation of thermodynamic functions of many types of refractory compounds. The accumulated thermodynamic data made it possible to formulate general mechanisms of change in the thermodynamic characteristics of different classes of refractory compounds and to determine their link with the electron structure of the elements forming the compounds.

As a result of investigation of a broad spectrum of binary metal alloys, intermetallic phases and refractory compounds of various classes across a wide range of temperatures and compositions, as well as materials based on these investigations, the authors produced a massive file of reliable thermodynamic information. They have studied the most important items of modern technology--superhard, heat-resistant, magnetic, superconducting, and semiconductor materials, refractory materials, and melts in nonferrous and ferrous metallurgy. They have established new basic properties of alloys and compounds with metallochemical characteristics of constituents, and their

electron structure and place in the Periodic System. Methods of reliable prediction of thermodynamic properties of uninvestigated substances have been developed on the basis of the obtained experimental materials.

The scientists' own information as well as information from the literature on the properties of approximately 2,000 substances are critically analyzed and synthesized in 8 reference-type monographs and volumes of collected research papers. The scientific results obtained by these investigators have been incorporated in basic thermodynamic reference works published both in this country and abroad. A large part of the thermodynamic information has been entered into the data bank of the ASTRA automated system of thermodynamic calculations of the special design bureau at the Institute of Problems of Material Science of the UkSSR Academy of Sciences and is a component part of the CEMA Standard Data System files.

This thermodynamic information is being used to solve various engineering problems at Soviet chemical and metallurgical enterprises, in developing optimal conditions for synthesis of refractory compounds, in developing high-temperature ovens, specialized ceramics, refractory materials, catalyst holders, highly efficient cathodes, and protective coatings.

The thermodynamic research on metal alloys performed in recent years by staff members of the Institute of Problems of Material Science of the UkSSR Academy of Sciences in collaboration with scientists from Ukrainian higher educational institutions, by their breadth of encompassment of various classes of substances, sophistication of experimental techniques, and depth of scientific syntheses, hold a leading position in Soviet high-temperature thermodynamics of inorganic materials and in large measure define our country's leadership position in world science.

Academician of the UkSSR Academy of Sciences V.I. Trefilov

Industrial Method of Installing Steel Technological Pipelines

A considerable amount of work involving installation of technological pipelines is performed during construction of chemical plants, oil refineries, metallurgical plants, and enterprises in other branches of industry. Providing these branches of industry with new, high-output equipment and boosting this equipment's basic operating parameters imposes stringent demands on the quality of manufacture and installation of lines through which gases and liquids--inert and toxic, explosive and flammable--are conveyed. The temperature of conveyed products ranges from -253 to +1200 degrees Celsius, while pressure ranges from an ultrahigh vacuum to 250 MPa (2,500 kg/sq cm).

The time required to bring industrial installations on-stream and to reach a plant's design output capacity, normal and accident-free operation of technological lines and equipment, and the service life of structures operating in various environments and conditions depend in large measure on on-schedule, high-quality installation of pipeline systems.

Until recently the fabrication and installation of pipeline systems were done manually on exposed sites, to where the pipe sections, fittings, and so on

would be hauled. Lines with branchings in various spatial positions would be laid, pipe sections cut, connecting fittings fabricated, joining and welding, anticorrosion and other critical jobs would be performed on the same exposed site.

Labor productivity with this mode of production was usually poor, and therefore quality and longevity of lines left something to be desired. It was essential to take urgent steps to eliminate this "bottleneck" on the basis of incorporation of advances in science and technology, advanced processes, and new, advanced equipment. Over the period of many years a team of specialists at the UkrSSR Ministry of Installation and Special Construction Work and the Institute of Electric Welding imeni Ye.O. Paton of the UkrSSR Academy of Sciences persistently sought ways to accomplish this task.

Today high-output pipe fabrication shops, equipped with continuous-flow lines and sections for the manufacture of pipe assemblies, branchings and sections, as well as large modular units of piping, have gone into operation at locations where construction is concentrated, which has made it possible to industrialize labor-intensive operations previously performed right on the construction site. These continuous production lines and sections use modern equipment for compressed-air plasma cutting, assembly and mechanized welding of pipe. Kiev-4 and AVPR-2 equipment has been developed as a result of plasma-jet cutting research and is being series-manufactured. This has increased the productivity of continuous lines, decreases production costs, and results in savings of basic and auxiliary materials.

The use of compressed air as the sole gas has resulted in a high degree of efficiency and economy of the cutting process, which has promoted reduced consumption of oxygen and calcium carbide. A plasmotron, the chamber of which has made it possible to produce the requisite quality of forming of the compressed-air jet with minimal losses of power in the cutting torch and therefore ensures high thermal efficiency, faster and better-quality pipe cutting, is the result of tireless efforts on the part of scientists and production people.

The proposed engineering solutions also result in excellent service life for replacement parts, a longer period of equipment operation without readjustment, as well as total equipment reliability and malfunction-free operation.

In addition the new process guarantees high quality and lack of contamination of the edges of the cut with oxides, which has eliminated the need for subsequent grinding-wheel treatment prior to welding.

Centralized fabrication of piping on mechanized lines and in pipe fabrication shops is the main way to go for increasing labor productivity, achieving failure-free operation of production lines and equipment, and to achieve longer-lived structures. Since labor-intensive and heavy jobs have been mechanized, the very work process has taken on a fundamentally new character.

The scientific research results have been incorporated into high-speed construction of industrial facilities in Kremenchug--an oil refining industry

center, in Cherkassy, Pervomaysk, Severodonetsk, and Gorlovka--heavy chemical industry areas, on construction of the Odessa Port Industry Plant, at the Zhdanov Metallurgical Plant imeni Ilich, at compressor stations along the Urengoy-Pomary-Uzhgorod trunk and branch distribution pipelines, and on other construction projects in this republic.

Aggregate savings from adoption of these industrial methods total in excess of 5 million rubles.

Thus, thanks to implementation of scientific and technical achievements in the area of installation and special construction activities, organization of centralized fabrication and delivery to job sites of pipe assemblies with an increased degree of prefabrication and, in addition, large modular-unit high-speed installation of industrial piping and lines, a powerful foundation has been secured for achieving on-schedule and ahead-of-schedule movement on-stream of important Ukrainian industrial facilities of considerable engineering complexity, as well as meeting of targets pertaining to boosting labor productivity, reducing construction costs, and achieving savings in resources.

The authors of this most significant research and development project quite deservedly have won high recognition, by being awarded a UkSSR State Prize; they include Valeriy Andreyevich Kozhema, department head at the Institute of Electric Welding.

Academician of the UkSSR Academy of Sciences D.A. Dudko

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CSO: 1814/258

GENERAL

RESULTS, PROSPECTS OF MATHEMATICAL ECONOMICS RESEARCH

Moscow EKONOMICHESKIYE NAUKI in Russian No 6, Jun 86 pp 25-35

[Article by Doctor of Economic Sciences Professor V. Danilov-Danilyan: "On the Results and Prospects of the Development of Mathematical Economics Research"; passages within slantlines published in italics; first paragraph is EKONOMICHESKIYE NAUKI introduction]

[Text] In the resolution on the Policy Report of the CPSU Central Committee the 27th CPSU Congress pointed out: "It is necessary to put the fundamental tasks in the acceleration of the progress of our society and its achievement of a new qualitative status at the center of social science research." Since, as is recorded in the same document, "economics was and remains the main sphere of party activity," economic science in the entire richness of its various directions plays an exceptional role in ensuring the progress of social science research. The mathematical economics direction is one of them and undoubtedly an extremely important and promising one from the standpoint of contemporary scientific and technical progress, on the one hand, and the greater and greater realization of the tasks of the balanced development of the national economy, on the other hand. Our society has a right to expect of it significant successes and a major contribution to the achievement of the highest organization and efficiency of the economy with thoroughly developed productive forces, mature socialist production relations, and a coordinated economic mechanism. How is one to attain such successes? In publishing the below articles of V. Danilov-Danilyan and P. Medvedev to begin the discussion, we invite economic scholars (and not just those specializing in mathematical economics studies) to find a constructive and specific answer to this question on the basis of the interpretation of the already substantial experience of the development of Soviet economic science as a whole and this direction of it in particular.

The organizational shaping of the mathematical economics direction in our country took place at the end of the 1950's and beginning of the 1960's. In the course of all of the following years this direction invariably enjoyed the attention not only of economists, but also of scientists of other specialties--of all those who were not indifferent to the scientific problems in the improvement of planning and the economic mechanism. This kind of interest is not surprising: in those years great hopes were linked with the development of the mathematical economics direction and not merely a

significant, but an exceptional role in the scientific support of the further progress of the socialist economy was frequently assigned to it.. Thus, speaking on behalf of a major scientific collective, Academician N.P. Fedorenko said: "We are thoroughly convinced that the accomplishment of the task of the drafting of not simply balanced, but also the most efficient variants of the plan is possible only on the basis of the theory of optimum planning." (Footnote 1) ("Diskussiya ob optimalnom planirovani" [Discussion on Optimum Planning], Moscow, 1968, p 7). It was further noted in the same statement that "the started theoretical and practical work on the problem of optimum planning is called upon to raise the management of the economy of our country to a new qualitative level and to provide a significant increase in the efficiency of the utilization of material, manpower, and natural resources in the interests of increasing the well-being of the Soviet people." (Footnote 2) (Ibid., p 31). Some were optimistic about such demands--and they have been made hundreds of times in one form or another--others took a wait-and-see attitude, and still others were skeptical.

Almost 20 years have passed since November 1966, when the words cited above were spoken. The urgency of the problems of the improvement of planning and economic mechanism has not diminished at all during this time: as Comrade M.S. Gorbachev stressed in the Policy Report of the CPSU Central Committee to the 27th CPSU Congress, "economic management obviously also needs continuous improvement. But now the situation is such that one must not confine oneself to partial improvements--radical reform is necessary." (Footnote 3) (M.S. Gorbachev, "Politicheskiy doklad Tsentralnogo Komiteta KPSS XXVII syezdy Kommunisticheskoy partii Sovetskogo Soyuza, 25 fevralya 1986 g." [Policy Report of the CPSU Central Committee to the 27th CPSU Congress, 25 February 1986], Moscow, 1986, p 41) To what extent did the mathematical economics direction contribute if not to the resolution, then at least to the study of these problems? To what degree did it fulfill its own program, which was announced during the period of its formation? What are the lessons of the path that has been traveled and what are the prospects of the further development of this direction? In the present article we will attempt to state only a few opinions on these questions, without aspiring to their complete coverage. It goes without saying that here only the personal opinion of the author, which cannot fail to be subjective, is presented here.

Preliminary Comments

The results of any process can be evaluated only by comparing them with the goals posed in connection with its accomplishment. One must, however, keep in mind that, first, the initially specified goals might not fully correspond to the real internal possibilities and external conditions of the occurrence of the process and, second, for long-term large-scale processes it is usually not possible to set the goals absolutely definitely and operationally. Given the noted circumstances the results are frequently evaluated so that the goals in the original formulation are replaced by their retrospective reconstruction. If one approaches the question exclusively with respect to content, that is, if one speaks of the interpretation and understanding of the task, then here the matter is even more complex: to a significant, if not dominant degree the new understanding is the indirect result of the process itself and would be senseless without it. The old understanding of the goals inevitably loses the

quality of being organically discernible: in order to look at the problem from the old point of view, a certain restraining of oneself, at which even those, who to a great extent have the capacity for such "reembodiment," are successful far from without fail, is required.

At the same time, if it is a matter of the process of research and the formation of a scientific direction and a field of science, the refinement, specification, and operationalization of the understanding (sometimes one can say more--realization and explication) of the tasks and conditions of the flow of the process can be assumed to be one of the goal components. This relates above all to the social sciences, the processes of whose development are an integral part of the very object of their study.

As a result the problem of evaluation becomes much more complex. As applied to the results of the development of the mathematical economics direction, it is legitimate, in our view, to say that an unequivocal evaluation is hardly possible; moreover, it is, perhaps, also not necessary. Nevertheless, one should understand what problems this direction has solved and what problems it still has to solve, where substantial success was achieved and where the research are still in the initial phase.

Finally, it is necessary to note that this scientific direction (hereinafter for brevity we will call it the ME-direction; accordingly we will use the terms "ME-methods," "ME-models," and others) as a whole is heterogeneous. In it a "nucleus," which is represented by the Central Institute of Economics and Mathematics of the USSR Academy of Sciences, is quite specifically distinguished. But there are also other schools, which are less numerous, as well as groups and simply individual researchers, who can be assigned more or less arbitrarily to the ME-direction, although they do not necessarily declare this themselves. Within the framework of the direction so understood (its criterional characteristic, in our view, is the orientation of the studies toward mathematical methods either as the main means of solving some specific or in general any economic problems or others or as an end in itself), of course, there are divergent viewpoints on specific, and sometimes on general, problems of theory and practice, but no obvious sharp debates within the direction are noticeable, scientific "battles" are waged only with other directions, while the "nucleus" completely demonstrates an unusual cohesion (in our view, this is a great shortcoming for a scientific direction: the internal potential of development is lessened, secrecy and isolation become not simply the form, but to a certain degree the meaning of the school's existence as well).

Understanding full well that a number of the opinions expressed below cannot be assigned specifically to each of the representatives of the direction, we nevertheless believe that they are justified as applied to the direction as a whole, although like it or not one has in mind primarily its "nucleus" in such cases. In accordance with its characteristic priorities, optimization is recognized as predominant in ME-problems. Some of our conclusions can be applied directly only to the optimization concept and optimization methods; nevertheless, a somewhat broad interpretation of these conclusions can be justified, first, because of the specific role of optimization concepts in the ME-direction and, second, as a result of the fact that methodological aspects

of the utilization of optimization and other "precise" mathematical methods display much in common--if not identity, then at least profound analogies.

Initial Situation

The late 1950's and early 1960's, when the mathematical economics direction took shape organizationally, were not, of course, the beginning of ME-research: it was developed earlier as well--by V.V. Novozhilov and T. Koopmans in the 1940's, L.V. Kantorovich and J. von Neumann in the 1930's, and so on, all the way back to O. Kurno (in the 1830's) and his predecessors. (Footnote 4) (See, in particular: A. Cournot, "Recherches sur les principes mathématiques de la théorie des richesses," Paris, 1838; J. Von Neumann, "Über ein ökonomisches Gleichungssystem," ERGEB. MATH. KOLLOQUIUMS, No 8, 1937; L.V. Kantorovich, "Matematicheskiye metody organizatsii i planirovaniya proizvodstva" [Mathematical Methods of Organizing and Planning Production], Leningrad, 1939; V.V. Novozhilov, "Sposoby nakhodcheniya maksimuma effekta kapitalovlozheniy v sotsialisticheskem khozyaystve/Trudy Leningradskogo finansovo-ekonomicheskogo instituta" [Means of Finding the Maximum Effect of Capital Investments in the Socialist Economy/Works of the Leningrad Institute of Finance Economics], No 3, 1947; Ts. Koopmans, "Analysis of Production as an Efficient Combination of Activities" in "Activity Analysis of Production and Allocation," New York, 1951) But almost all of these works concerned the application of mathematical methods in theoretical economics. Of decisive importance for the formation of the view of ME-research as being called upon to play a directly applied role was the qualitative change in applied mathematics, in the assessment of the possibilities for the introduction of mathematical methods into the most varied areas of practical work, which was detected in the 1950's with the spread of computer technology.

The end of the 1950's was a very specific moment in the history of economic science, which, perhaps, does not have precedents. On the one hand, the sense of the necessity of improving the management of the national economy in connection with imminent changes in the structure and distribution of production, the increase in its volume, the new understanding of the current social tasks, and so forth became especially acute. On the other hand, it seemed that practice finally got access to a tool, by means of which such a desirable jump in the improvement of management can be achieved. The coincidence of the two noted circumstances predetermined a great deal in the future development of ME-studies in the USSR. It also had a decisive influence on the nature of the specific aims for this direction.

It seems to us that at that time there was not, and there could not yet be, a completely clear understanding of such specific aims as operational: the establishment of operational goals presupposes a profound preliminary analysis of the problems and a theoretical interpretation of their content, but these conditions still remained to be fulfilled. It cannot be said that they have been fully realized even now, although, in our view, the progress has been substantial. One can, of course, dispute the assessment given above of the situation at the end of the 1950's, and it is quite simple to do this: pick up the publications and documents of those years and find in them formulations that appear more or less operational. But the fact is that such an impression is created now, whereas 20-25 years ago the understanding and preception of

all this was quite different. As a result the theoretical and applied goals proved to be combined, even mixed, and this was also unavoidable at that time. In the general understanding the goal of the new, forming ME-direction was taken to be approximately thus: in developing the necessary divisions of economic theory, to ensure the qualitative improvement of the planning and management of the national economy on the basis of the introduction of ME-methods and computers.

In those years practically no one adequately assessed the complexity of the theoretical component of this, in the terminology of contemporary systems analysis, poorly structurized problem.

On the one hand, practically all the researchers, who had worked within the ME-direction, underestimated this complexity. Most of them were guided by simplistic concepts of economic reality and the certainty that the necessary theoretical investigations can be fulfilled by relying primarily on mathematical and cybernetic disciplines. The indicated direction suffered from the exaggeration of the possibilities of mathematical methods in the development of substantive theories and the importance of the "direct" automation of management and at the same time from the underestimation of the individual, the creative element in this area. All of this led to a primitive understanding of the forms, methods, and role of the utilization of models and computers in management and to inordinate emphasis on the invention of abstract "ideal" constructs to the detriment of the study of the reactions of the real economy to specific controlling influences.

To a considerable degree such a situation can be explained by the age structure of the personnel who initially determined the scientific and theoretical potential of the ME-direction: besides a few "patriarchs"--economists of the older generation and literally two or three scientists of the middle generation--all of the rest were young people (no older than 35 years of age) who, although in large part talented, were insufficiently familiar both with economic practice and with the history of economic science. It is understandable that this situation adversely affected the development of the emerging direction through initial weaknesses.

On the other hand, economists who in those years did not turn to ME-methods not only did not want to make use of the new means of research, but for their most part did not understand that the very appearance of these means in the arsenal of economic science presents it with new methodological tasks, individual aspects of which can also be studied without the direct use of such tools. In addition, and this is more important, /the necessary theoretical foundation for the successful constructive development of the new direction undoubtedly should be built by the efforts of all Soviet economic science/, which is based on the analysis of the practice of real management. So far, however, the understanding of this circumstance is painfully and with difficulty makes its way into the world and has not yet become a reality for many economists working both within the ME-direction and outside of it.

Perhaps only V.S. Nemchinov was an exception in the sense that, first, he by no means exaggerated the real possibilities of the "mathematization" of economic science and management practice and, second, he took in so doing an

active position, promoting in every possible way the effectiveness of theoretical studies and the use new methods.

Given everything that has been said here, one must not consider the fate of the ME-direction as some exceptional one. Some undesirable expenses or others and negative side effects are inevitable in any process of development; the process of the development of science and of the formation of a new scientific direction is also no exception. Some such consequences can be prevented and others alleviated, but in this case as well it is, as F. Engels put it, futile and arbitrary to discuss events that cannot be foreseen in advance. (Footnote 5) (See: K. Marx and F. Engels, "Sochineniya" [Works], 2d edition, Vol 27, p 318). Nevertheless, it is essential to try to understand the reasons for some significant phenomena or others.

Objectives of the Mathematical Economics Direction From a Contemporary Point of View

Proceeding from present notions, that is, if possible taking into account the lessons of the development of the ME-direction, let us attempt to formulate those tasks (components of the overall goal) that had to be accomplished in connection with the need for the reequipment of the management system on the basis of computers and mathematical methods and the transition to the broad utilization of these resources in economic science itself.

1. It was necessary to prepare a extensive group of economists and workers in planning and economic organs to accept the very idea of the necessity and inevitability of such a substantial addition to the tools being used, in other words, to accomplish the task, which is associated with the overcoming of the notorious "psychological barrier," but is by no means reducible to this alone. The "psychological barrier" is usually linked with subjective factors that hinder the utilization of a completely finished set of tools, which is ready for use, has been checked by others, and has given a quite good account of itself; the function, whose performance is hindered by the "psychological barrier," is all the same relatively passive. In this case we also have in mind the orientation toward active participation in the process of the mentioned reequipment, in the formation of the order for specialized new means, in the selection and formulation of the tasks, and so forth.

2. It was necessary to determine a common strategy for the elaboration and introduction of ME-methods and computers into management. First of all the ranking of the classes of management problems according to the sequence of the enlistment of new means in their solution belongs here. Here, of course, it can be a matter only of rough estimates and not of some "inviolable" sequence, moreover, such a ranking certainly presupposes coordination with the other problems named below, as well as consideration of the prospects for the development of the production of computers and the status of studies in computing mathematics, information science, systems programming for computers, and in other related disciplines.

3. The analysis of the organizational, legal, and economic questions of the reorganization of the management system in connection with the qualitative change in its technical base was mandatory. The outlet to the problems of the

improvement of the economic mechanism as a whole is obvious here, for together with the given task one should also examine the questions of the interest of the management organs of all units and levels in increasing the quality of management, improving accounting and control, submitting to superior organs (as well as related entities and other contracting parties) timely accurate information, and so forth.

4. The problems of the methodology of mathematical economics modeling and the methods of utilizing models both in theoretical research and in the system of economic management--in the processes of planning, in the making of administrative decisions, and in the accounting and control services--needed to be studied. Here both general and special methodological problems should have become objects of the analysis, but it was especially important not to be limited merely to those of them that arise at the stages of the construction and study of the models: of no less substantial importance are the methodological and procedural problems of "bordering" stages--the formulation of the modeling tasks and the direct application of the models in practice.

5. Numerous problems of a mathematical, computing, system-programming, and technical nature also required solution, although the entire development of the ME-direction showed, in our view, that in reality its bottlenecks were not at all linked with the solution of these problems.

Of course, the formulation of the goals of a developing process is, in a certain sense, always a thankless task, because a priori attempts to set some limits on development inevitably smack of scholasticism. Only one conclusion, however, follows from this: the management of development must be flexible, it is essential to correct the established goals by taking into account the accumulated experience and the new prospects that are opening up, and the actions taken should contribute to the acceleration of the process and the elimination of factors limiting development, but should not lead to the suppression of points of growth, if there are reasons to expect positive results from them and if they can open up new possibilities in the future. Taking this observation into consideration, one should also judge the five tasks formulated above and the extent to which the ME-direction made progress in their accomplishment. Below they are discussed in sequence (except for the fifth, on which there is no point in dwelling in greater detail in this article).

The "Psychological Barrier" and the Strategy of Introduction

In our view, the ME-direction achieved the most obvious successes in the accomplishment of the first task. Active and persistent promotion on the idea of the necessity of introducing computers and ME-methods in the management of the national economy and their use in theoretical research on economics, which is effective above all thanks to the internal conviction of the representatives of the ME-direction of its correctness and feasibility, achieved the goal. Although the "psychological barrier" has not been completely eliminated, it is not as significant as it was 20 years ago. Numerous demonstration examples of the application of ME-methods, which were prepared by researchers, contributed to this. True, in most cases the corresponding developments were intended not for demonstration, but for

practical adoption but in many cases it was not possible to achieve the latter for some reasons or another.

Within the first task it is natural to distinguish a minimum program and a maximum program. The former of them--the overcoming of the "psychological barrier" in the management area and the resolution of a number of related, less important questions--can be considered fulfilled. Certainly, the credit cannot be given entirely to the ME-direction; a large role here was played by the development of computer technology, the tremendous increase in the scale of the production of computers, and the automation of industrial processes. All this was able to prove effective because of the constant attention that the CPSU and Soviet Government paid to the problems in the improvement of the system of management of the national economy, including its reequipment. As for the maximum program, which presupposes, in particular, the active participation of production managers in the very process of the introduction of new means and in the formulation of demands on the latter and the "order" to researchers and designers, it is still far from completion. The situation here appears very mixed, if one looks at different sectors of the national economy. Obviously, substantial progress "along the entire front" can be achieved only on the basis of the measures of a certain stage of the improvement of the economic mechanism; here, by the way, it is a matter of the sphere that we previously ascribed to the third task.

As for the "psychological barrier" not in the management area but, in economic science itself, then it can be asserted, if one takes a formal approach to the matter, that it has been completely overcome: all economists now in words are in favor of the use of mathematics and all recognize mathematical methods as an essential component of economic research. In practice, however, the line of demarcation between those who apply mathematics or at least use the results of such application and those who actually avoid ME-methods is quite apparent. Undoubtedly, improvement of the matter can be achieved only through the joint efforts of both sides. We still have frequent see instance when an economist expects a ready-made mathematical method for the "solution" of a poorly structurized problem. Here it is not just a matter of passivity, but also of the lack of understanding of the role that formal methods can play in solving similar problems (let us note that almost all economic problems are poorly structurized): in principle, these means cannot provide a ready-made solution in such situations, but should be used only as an element in the generally nonformal procedure for finding and justifying a solution.

In connection with the overcoming of the "psychological barrier" it is worth noting another danger. Since the introduction of the ASU [automated control system] has become an integral part of the plan for new equipment, there are frequent instances when some ME-models or others in reporting are registered as introduced, even though they have not even been brought up to the programming stage. A formal bureaucratic, in essence deceptive attitude toward the matter can produce a stream of low-quality developments, which in practice are not suitable for anything and exist only for reporting.

The problem of the determination of an overall strategy for the introduction of computers and ME-methods into management has been studied by many economic mathematicians, but in solving it they usually relied on superficial

classifications of tasks. They took into account not so much the economic essence of the matter as the formal characteristics: the structural levels, sectorial affiliation, the time horizon, and so on. Although the term "diagnostics" appeared early in the research, it was applied only with respect to enterprises in case of ~~the~~ re-signing, which, by the way, produced no real success. The existing classifications and diagnoses were applied primarily to the objects and not to the tasks of management and decision making. As applied to tasks of this kind a type of ME-model, to which formalization led, was used as the basis of classification. But an even more significant circumstance than the type of model is the nature and methods of its utilization in the decision-making process; linkage with the problems of the fourth of the five tasks of the ME-direction, which will be discussed below, occurs here. Let us now merely note that our economists have dealt extremely little with the theory of decision making: mainly only its technical applications are being developed.

Improvement of the Economic Mechanism and the Introduction of ME-Methods and Computers in Management

The third task of the ME-direction is the most important, but precisely its importance was realized last, with a clear delay. And although the problem is now being studied actively, still, despite the full recognition in words of its importance, quite a bit of work on ME-modeling is in reality being performed with no consideration at all of the requirements of this task. It is important to note from the very beginning that this task, to a greater extent than the others, can be accomplished only through the joint efforts of economists of all directions and experienced workers.

There are a lot of reasons for the noted delay, but let us note only two very significant reasons. /First/, the frequently displayed aspiration of representatives of the ME-direction to view formal constructs as an absolute, regardless of the specific economic practice and, therefore, actually separating themselves from the problem of their realization (or, what essentially is the same thing, presupposing the possibility of the direct imputation of any deductively determined characteristics, for example, the "optimally functioning" formal system), had an effect. Such an aspiration has an epistemological explanation, because it is always simpler to produce ideal constructs than to identify their connection with reality. /Second/, the economists, who avoided the view of a formal system, in their overwhelming majority were inclined to present the matter in such a way that both the development and the introduction of new methods are the "internal" affair of the ME-direction and to separate these tasks from their own, to which they also ascribed the improvement of the economic mechanism. As a result even now, when the realization of the true problems is becoming more and more widespread and profound, the constructive striving toward a synthesis of different directions is not that often encountered.

In any event, the understanding of the fact that the retooling of the management system—with respect to the content, the essence of the latter—will not lead to positive results, has become practically universal. The automation of the procedures of operational management of an enterprise will not at all necessarily yield real positive results for the national economy,

if the interests of the enterprise are not coordinated with the interests of the national economy. The "optimization" of current or long-range planning, the introduction of information systems, and other similar measures can contribute to essentially anti-economic activity, if the users of such systems take a departmental, and not a national economic position.

This was perhaps pointed out with full certainty for the first time by economic mathematicians. A question however, arises: What role can ME-methods play in solving problems of this sort? Undoubtedly a significant one, but not so much prescriptive (normative) models, which are oriented toward the "designing of new mechanisms," as methods that help in the study of practice, that is, descriptive methods, are needed here. A large number of normative models, particularly optimization models, find no application precisely because no scientific basis was established to evaluate the real possibilities and consequences of their introduction, as well as the specific forms of utilization. The application of ME-methods for the study of economic practice and the analysis of the quantitative aspects of the laws of the economic development of the country has been outlined only in recent years and it is still too early to speak of any results. (Footnote 6) (Here we do not mean macromodels of the econometric type, which, despite all of their theoretical and applied importance, have very little to do with the problems of the improvement of the economic mechanism, the "synchronization" of this process, and the retooling of the management system)

There is no doubt that the most important reason for the noted lag is the inadequate elaboration of the political and economic aspects of the problem. Recognizing this, the representatives of the ME-direction frequently try to elaborate these aspects themselves, but positive results in this case are rare. It is not difficult to indicate the reason: as usual, economic mathematicians try to use formal methods of research here, but /the more profound and substantive the socioeconomic problem is and the more essential the study of production relations is for it, the more difficult it is to develop a procedure of the application of formal methods/. It should be stated that the questions being discussed have still been studied very poorly even for relatively simple cases, inasmuch as practically no attention has been paid to them. But this is the sphere that we have ascribed to the fourth of the five tasks formulated above.

Questions of the Methodology of ME-Modeling

In our view, the fourth task remains the least studied. Perhaps the main reason here is the insufficient attention to the problems of the methodology of economic science and the specific application in a given area of the dialectical method over a long period of time (let us emphasize that we have in mind real constructive attention and not declarations about the methodology, a lack of which has never been felt).

In particular, the application of mathematical methods (just as, by the way, the development of economic science as a whole) is inconceivable outside economic measurements. Measurement in economics is a qualitatively different problem than in physics, for example, in connection with which the entire concept of quantitative analysis (regardless of whether a serious body of

mathematics is used) should be fundamentally different than in the same physics. Nevertheless, economists have in practice adopted physical concepts of measurement and, with the exception of a few statisticians, experience in this regard neither confusion nor inconveniences (that is, there certainly are inconveniences, and there is much more than simply inconveniences, but quite different circumstances are usually given as their causes).

For various reasons, including the specific nature of economic measurements, models in economics are a "crude" means and their utilization both in theoretical research and in the practice of managing the economy cannot be analogous to the application of "precise" models of equipment or classical natural science. The elaboration of special procedures and particular methods of the use of models is necessary here, and the main thing in this case is the consideration of the goal and specific conditions in the utilization of a formal system--questions from which the makers of models are frequently completely divert their attention. In our view, the prolonged discussion of the problem of the evaluation of the economic efficiency of economic measures (particularly capital investments, the introduction of new equipment, and so forth) is being sustained by the insufficiently clear understanding of the noted circumstance by the participants in this discussion, no matter to which direction they belong.

The methodological aspects of the third and fourth of the five named tasks are undoubtedly related and this is more noticeable the more abstract the questions under review are and the more widely studied the problems are. It is seen very quickly that it should be a matter of the methodological problems of economic science as a whole--their inadequate elaboration affects literally all applied research, not to mention theoretical research. The very principles of the reflection of economic reality by economic science, the influence of this reflection on social structures and the "economic consciousness," the operational role in management of the instrumental tools, which are offered by economic theory, and so forth have been poorly studied. Although such problems are general economic ones, for some reason representatives of the ME-direction turn to them more often. An especially solid and broad foundation and reliance on philosophy, theoretical sociology and the methodology of science are required for the study of these problems. Inasmuch as every scientific school usually tries to fill the gaps in the foundation with the means at hand, economic mathematicians naturally use modeling for this purpose. In so doing, a by no means favorable result is obtained: attempts to replace content analysis with the application of formal means invariably become the object of criticism and the rational grains of such research, if they exist--remain unnoticed or go undeveloped.

Thus, the interest of economic mathematicians in general economic problems stems first of all from the fact that they, first, constantly present researchers in the course of the study with relatively special tasks and, second, remain inadequately elaborated (and if, as V.I. Lenin wrote, the general questions are not resolved, then one has occasion "inevitably...at each step to unconsciously for oneself 'come across'" them), (Footnote 7) (V.I. Lenin, "Polnoye sobraniye sochineniy" [Complete Works], Vol 15, p 368), and, third, epistemologically conditioned inertia frequently pushes economic mathematicians from the abstract merely to the even more abstract and not to

the specific (let us note that to settle general questions it is necessary to move in both directions). This aspiration, which is appearing quite obviously, is the reason why general economic questions are frequently raised precisely for representatives of the ME-direction. Thus, it is possible to recall that in 1973 at a meeting of the Presidium of the USSR Academy of Sciences during the discussion of the report of the Central Institute of Economic and Mathematics then President of the Academy of Sciences M.V. Keldysh in the closing speech, addressing the institute workers, noted the vagueness of the basic questions: "What is a plan? What, in general, is the management of the economy?" and so on.

An analysis of these problems will hardly be successful, if one does not make use of /the entire arsenal of the means of economic science/. In enlisting one or another of them, however, one should clearly imagine the real possibilities of its application. What can the use of the modeling method yield in economic theory itself, particularly in the solution of those of its problems that belong to political economy or closely concern them? We answered this question several years ago: "In analyzing such concepts as the socially necessary expenditures of labor, price, rent, and so forth, both the socialist economy as a whole and the production relations immanent in it should be the object of modeling. And since an optimization model, which describes the entire complex of reproduction processes and is intended for the analysis of the role that the named concepts play in them, can hardly be built, such studies can only contribute to the disclosure of individual aspects of the content of the categories and concepts of the political economy of socialism, but cannot lay claim to a complete explanation of such content (this also applies to any formal mathematical constructions)." (Footnote 8) ("Ekonomicheskaya entsiklopediya. Politicheskaya ekonomiya" [Economic Encyclopedia. Political Economy], Moscow, 1980, Vol 4, p 648; see also pp 527-532) It seems that this answer is applicable today as well.

A quite paradoxical situation has arisen: more and more representatives of the ME-direction are concentrating their efforts not on the quantitative analysis of economic problems (that is, not on the investigation of quantitative aspects of the laws of its development and functioning, the questions of improving the management of the national economy, and so forth, but on the formal analysis of substantive problems, proceeding from an unjustifiably broad idea of the possibilities of formal means in such cases. Not being supported by in-depth studies in the area of methodology, this work proves to be ineffective. True, it helps to raise new questions that promote the development of theory, but only up to a certain time (which, it seems, has already arrived in this case).

Let us stress that /the participation of economic mathematicians in the analysis of the most general problems of economic theory and the use here of the ME-tools are not simply possible and not only desirable, but also necessary/. Especially important in this connection are the strictness and consistency of the constructions, which are cultivated best of all by mathematics (although, of course, not only by it). /In such work, however, one must not, first, forget about the primary importance of the substantive-economic statement of the problem in each theoretical study and, second, lose sight of the specificity of the application of a formal apparatus in

theoretical economics and the necessity of settling the corresponding methodological and procedural questions/.

Results and Prospects of the ME-Direction; Final Observations

Naturally, our objectives do not include the compilation of a systematized list of all results obtained by the ME-direction, their "inventory." We are interested in the overall evaluation of the extent to which this direction succeeded in making progress in accomplishing the tasks facing it (including those revealed in the course of its development) and in the assessment of the role that it now plays in economic science and of the influence that it has on practice. The matter is not limited, of course, to the five tasks formulated above, especially if one also considers the indirect results.

On the whole the ME-direction, in our view, was of positive value importance in the development of our economic science, despite the fact that the practical return of ME-research for the present does not fully justify the expectations, theoretical errors are frequent, the scientific forces have not been distributed in the best manner, and so forth. /The development of the ME-direction, first, prepared the basis for the introduction of new technical means in management, second, played a significant role in the development of a system of concepts and scientific tools, which are necessary for the practical utilization of these means, and, third, contributed to the formulation and study of the new problems of economic science, which conform to the current level of development of the productive forces and production relations in our country/. The fact that today we can clearly and definitely formulate the shortcomings inherent in ME-research and discuss unresolved tasks in a sufficiently operational manner is also largely a service of the ME-direction. The work of economic mathematicians accentuated the methodological questions of economic science and drew attention to them.

It should be specially emphasized that for their most part the errors and defects of the ME-direction are the costs of scientific development and it is possible to discuss and criticize them while holding on to scientific positions. Unfortunately, the polemics against the ME-direction is not always characterized by this quality, a clear reduction of the scientific level in comparison with the criticized, even if erroneous, concepts is frequently characteristic of it. Perhaps it is woth clarifying this remark: it is a matter of the quality of the line of reasoning, which can be less than the scientific standard even when the overall conclusion is correct (for example, the statement: "There is no thermogen, because I did not see it" is unscientific, even though there is indeed no thermogen).

The spread of "developments" and "concepts" that are weak imitations relative to it does great hard to the ME-direction, just as to any other scientific school. We already noted above the danger of the intensification of the stream of low-quality models within automated control systems--models whose insufficiency is obvious to every serious economic mathematician. On the same level we should also name the numerous efforts to "apply" methods of mathematical statistics (correlation and regression analysis, studies of time series, and others), when the corresponding procedures of data processing are used quite mechanically, with no substantive formulation of the task,

verification of the conditions of correctness for the application of the algorithm, the interpretation of the results, their correlation with observable phenomena, and so forth.

Naturally, one must not declare empty formalism to be a secondary consequence of the development of mathematics alone; its manifestations are also frequent in areas far removed from it. Nevertheless, formalist work in economics (by no means do we equate it with the scientifically sound application of formal methods) is always "placed" under the ME-direction or to trends that are related to it certain respects and are not always separable from it--systems analysis and so forth.

In this sense many works on organizational management structures, which are now so widespread and are based neither on constructive scientific tools (they simply do not exist in this area) nor in most cases on a qualified idea of the real economic problems, are also unoriginal. The attempts here to apply regulated expert procedures and so forth also do not stand up to criticism. Objectively the abundance of organizational structural developments contributes to making the management of the economy bureaucratic, for sets aside fundamental substantive problems of the development of the economy and ignores the qualitative differences of management tasks at different levels.

Externally quite different, but in reality similar shortcomings are characteristic of the search for "automatically operating" economic mechanisms. Inherent in all epigonic trends is their orientation toward the senseless borrowing of developments, which were carried out with other goals and under different conditions.

The spread of epigonic trends is largely explained by the acute, although at first glance not too noticeable shortage of qualified economic mathematicians. Instead of them staff units are very often occupied by casual people, who do not have a specialized education in either economics or mathematics, especially a mathematical economics education. However, as paradoxical as this may be, the number of graduating economic mathematicians at the Economics Faculty of Moscow State University, which is negligible as it is, was reduced to two-thirds a few years ago.

There is hardly any need to return to the question of the long-range problems in ME-research: they were named above among the five tasks of the ME-direction and were discussed to the extent acceptable for a journal article. The effective help of all economists, the constructive discussion of the results and methods of ME-research, active work in the area of the methodology of economic science, and the improvement of the provision with personnel are needed for the accomplishment of these tasks; we will not mention possible other measures, inasmuch as the corresponding questions were not examined above.

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BIOGRAPHICAL INFORMATION

ALEKSANDR NAZAROVICH SHCHERBAN

Kiev VISNYK AKADEMIYI NAUK UKRAYINSKOYI RSR in Ukrainian No 5, May 86 p 107

[Article under the rubric "Chronicle and Briefs": "The 80th Birthday of Academician of the UkSSR Academy of Sciences A.N. Shcherban"]

[Text] Academician of the UkSSR Academy of Sciences Aleksandr Nazarovich Shcherban, an eminent Soviet scientist in the field of mining thermophysics and automatic control of the state of production-environment air, has celebrated his 80th birthday.

Aleksandr Nazarovich went to work in the mines of the Donbass at the age of 16. He joined the Communist Party in 1927, still working as a miner in the Donbass. Upon graduating from the Dnepropetrovsk Mining Institute, he was employed from 1933 to 1941 by the Donshakhtoproekt Trust, sequentially serving in a number of engineering positions, right up to the position of trust general manager. During that period A.N. Shcherban began the first basic research in this country on heat conditions in deep mines, which subsequently made it possible to establish the mechanisms, unknown prior to that time, of complex transient heat and mass transfer in cavitated bodies of infinite size.

During the Great Patriotic War Aleksandr Nazarovich served in the Red Army and saw action against the German-Fascist invaders. This scientist has been working in the Ukrainian SSR Academy of Sciences system ever since the end of the war.

Serving as head of the Department of Mining Thermophysics of the Institute of Technical Thermal Physics of the UkSSR Academy of Sciences, he has formulated and solved important theoretical and applied problems in a number of important areas of mining thermophysics and gasometry. Methods of performing heat computations for deep coal mines, metal ore mines, drilled wells, and Earth's heat radiation circulation systems developed under his guidance are used by all this country's design institutes. Fundamentally new and effective mine air conditioning systems, gas protection systems for mines and other facilities, and systems for automatic monitoring of the air in urban and industrial centers, the world's first, were developed on the basis of ideas advanced by this scientist. Savings from incorporation of the results of his research run to the tens of millions of rubles.

A.N. Shcherban is the author of more than 400 scientific papers, including 15 monographs, which are widely known both in this country and abroad, and he is the author of approximately 100 inventions.

Aleksandr Nazarovich devotes considerable attention to the training of scientific cadres. His students include more than 30 doctors and candidates of sciences.

This scientist devotes considerable effort to scientific organizational and civic volunteer activities. In the period 1946-1961 he served as deputy director of the Institute of Mining of the UkrSSR Academy of Sciences, as chief scientific secretary of the Presidium of the UkrSSR Academy of Sciences, and as vice president of the UkrSSR Academy of Sciences; in the period 1961-1965 he served as deputy chairman of the Council of Ministers [as published] of the Ukrainian SSR Academy of Sciences. Aleksandr Nazarovich has served as a member of the Central Committee of the Ukrainian Communist Party and as deputy to the UkrSSR Supreme Soviet, 6th Convocation.

For his services to the homeland, A.N. Shcherban has been awarded the Order of the October Revolution, the Order of the Patriotic War, 1st and 2nd Class, has twice been awarded the Order of Labor Red Banner, twice awarded the Red Star Order, the Badge of Honor, and medals.

On the occasion of Aleksandr Nazarovich's birthday, the scientific community wishes him good health and continued future scientific accomplishments.

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YEVGENIY IVANOVICH KVASNIKOV

Kiev VISNYK AKADEMIYI NAUK UKRAYINSKOYI RSR in Ukrainian No 2, Feb 86 p 108

[Article under the rubric "Chronicle and Briefs": "The 80th Birthday of Corresponding Member of the Ukrainian SSR Academy of Sciences Ye.I. Kvasnikov"]

[Text] Honored scientist of UkrSSR and Corresponding Member of the UkrSSR Academy of Sciences Yevgeniy Ivanovich Kvasnikov, a noted Soviet microbiologist and USSR State Prize recipient, celebrates his 80th birthday on 22 February.

Ye.I. Kvasnikov began his professional career in 1925, while still a student. He dedicated himself to microbiology from 1929, working at scientific establishments and educational institutions. In 1961 Ye.I. Kvasnikov was named head of the Department of Physiology of Industrial Microorganisms of the Institute of Virology and Microbiology of the Ukrainian SSR Academy of Sciences.

The most important research conducted by Kvasnikov and his many students has been devoted to important problems in microbiology and elaboration of principles of controlling and regulating the vital activities of microorganisms utilized in industry and agriculture. In this research profound theoretical investigation has always been combined with solving problems of importance to the economy. Ye.I. Kvasnikov's studies in physiology, biochemistry, ecology, taxonomy, as well as breeding of bacteria and yeasts is of great scientific value. His basic research in such areas as synthesis of biologically active substances with microorganisms in specified conditions of cultivation are widely known, as is his research in the area of establishment of the mechanisms of interrelationships between them on natural and man-made substrates, elaboration of the principles of controlling their combinations, study of the heat tolerance of microorganisms and their applications in industry, discovery of new bacteria and their utilization for purifying industrial effluents of toxic compounds, etc.

This scientist's research involving investigation of hydrocarbon-assimilating microorganisms made a substantial contribution toward elaboration of the scientific basis for establishing in the USSR the world's largest high-tonnage production of protein-vitamin concentrates from crude oil. A series of

research studies on the biology of lactic acid bacteria formed the basis of recommendations on the biological preservation of plant materials, the development of new food products of disease-preventing and therapeutic significance, as well as efforts to combat infection in the fermentation processes industry.

New varieties developed through selective breeding techniques and new biotechnologies are being utilized in the economy with great economic effect.

This scientist's research results have been synthesized in more than 400 scientific papers (including 6 monographs), which have received high praise from the scientific community; he is the author of 41 inventions, 4 of which were awarded patents.

Ye.I. Kvasnikov devotes considerable effort to the training of scientific personnel. His students include 10 doctors of sciences and 51 candidates of sciences. He takes active part in scientific organizational activities and volunteer work. For approximately 25 years now he has chaired the Scientific Council on Problems of Physiology and Biochemistry of Microorganisms of the Ukrainian SSR Academy of Sciences, he served for a number of years as deputy chairman of the counterpart council of the USSR Academy of Sciences, for a long period of time served as a member of the presidium of the All-Union and Ukrainian Microbiological Societies, and presently serves as a member of the scientific and technical council of the UkrSSR Ministry of the Food Industry, as well as a member of the editorial boards of several national and republic journals.

The accomplishments of this scientist are held in high regard by the party and government. He has been awarded the Order of Labor Red Banner and the Badge of Honor, government medals, two Certificates of Merit of the Presidium of the UzSSR Supreme Soviet, is a recipient of the D.K. Zabolotnyy Prize of the UkrSSR Academy of Sciences, a gold medal of the Exhibit of Achievements of the National Economy, and a USSR Inventor Medal.

The scientific community wishes Academician Kvasnikov good health and continued scientific achievement.

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KIRILL BORISOVICH TOLPYGO

Kiev VISNYK AKADEMIYI NAUK UKRAYINSKOYI RSR in Ukrainian No 5, May 86 p 108

[Article under the rubric "Chronicle and Briefs": "The 70th Birthday of Corresponding Member of the UkrSSR Academy of Sciences K.B. Tolpygo"]

[Text] Corresponding Member of the UkrSSR Academy of Sciences Kirill Borisovich Tolpygo, a prominent theoretical physicist, celebrated his 70th birthday on 3 May.

After graduating from the Physics and Mathematics Faculty of Kiev State University in 1939, he went on to graduate study at the Institute of Physics of the UkrSSR Academy of Sciences. From 1941 to 1945 K.B. Tolpygo defended the homeland with weapon in hand against the fascist invaders.

Upon completing his graduate studies, K.B. Tolpygo first served as a junior scientific associate, and later as a senior scientific associate at the Sciences Institute of Physics of the UkrSSR Academy of Sciences, and as head of the Department of Theoretical Physics at Kiev State University.

In 1965 Kirill Borisovich was elected a corresponding member of the UkrSSR Academy of Sciences, and in 1966 he moved to Donetsk, where he established a department of theory at the Institute of Applied Physics of the UkrSSR Academy of Sciences and a department of theoretical physics at the university.

K.B. Tolpygo has made an important contribution to solving many problems in theoretical physics. His accomplishments in development of a dynamic theory of crystal lattices, kinetic properties of semiconductors, and theory of zonal and localized states of electrons and excitons are well known. Recently this scientist has also been working on current problems in biophysics and dynamics of populations.

K.B. Tolpygo is the author of more than 300 scientific works, including 4 monographs. Kyrylo Borysovych's students include 6 doctors and 30 candidates of sciences. As a scientist and civic activist he is characterized by a great deal of capacity for work, an uncompromising nature, and commitment to the task of solving current problems of science and practical application.

K.B. Tolpygo has been awarded the Order of the Great Patriotic War, 2nd Class, as well as a large number of medals.

On the occasion of his birthday, the scientific community wishes him good health and continued future accomplishments.

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